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GENERAL PLASTIC SURGERY*

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THE title "General Plastic Surgery" is used because I desire to impress upon the association the fact that plastic surgery should be visualized and taught as a whole, and not be thought of from the viewpoint of any of its subdivisions. Considerable misapprehension exists as to the scope of plastic surgery, the training necessary to do this work properly, and the type of man who can do it best. I hope that the following remarks will make these points clear:

Plastic surgery is that branch of general surgery which deals with the repair of defects and malformations, whether congenital or acquired, and with the restoration of function and improvement of appearance. Its field extends from the top of the head to the bottom of the foot, and the deformities dealt with, in most instances, involve the skin and adjacent soft parts and sometimes the framework (especially of the face) supporting these parts.

During the World War (1914–1918) plastic surgery was arbitrarily limited by military regulation to maxillo-facial reconstruction, and it is my opinion that this was a great mistake, and showed a profound lack of knowledge of its scope. Facial plastic and oral surgery is a very important part of the subject, but I wish to emphasize that it is only a part of plastic surgery and that plastic surgery of the trunk and extremities is as necessary and equally as important. The results may be less spectacular, but they are just as vital to the patient. For a number of years, as I have become more and more familiar with the intricacies of the subject, I have urged that plastic surgery be split from the general surgical tree and made to rank with such branches as orthopædic surgery or genito-urinary surgery. It has been difficult to convince the "powers that be" of the necessity of this, but the great popular interest in the subject during the war, and the fact that surgeons had to be specially trained in order to give the best results to wounded men requiring reconstructive work on the face, has had some effect, even on the most hidebound.

Plastic problems of the trunk and extremities differ materially from those of the face, and also require special study. When therefore it is realized that there is as much plastic work necessary to be done on these parts as on the

* Read before the Southern Surgical Association, Memphis, December 12, 1922.

face, it must be admitted by the ultra-conservative that the whole subject is one which demands special consideration. I have heard the remark "that now the war is over there will be no more plastic cases and no more use for plastic surgeons." This, of course, is simply an example of the general ignorance of plastic conditions, as there are always a great many cases in civil practice which require the special care of the plastic surgeon. For the most part they are old defects caused by disease, trauma, burns and necessarily mutilating operations, and also certain congenital malformations.

When the World War began, with the exception of the late H. Morestin in France, and one or two others elsewhere, there were no trained and thoroughly competent *general plastic surgeons.* I use this term to distinguish the few surgeons who have given special attention to plastic problems of the entire body, from those who have confined their plastic work to facial reconstruction of one sort or another. There are comparatively few men at the present time who could fully qualify under this term. However, I hope that within the next few years there will be a trained general plastic surgeon in every great hospital, who is capable of dealing with the plastic problems of the trunk and extremities as well as those of the face.

When men requiring maxillo-facial reconstruction began to come in from the front and were referred to the "head section," it was soon found that there were no surgeons available who knew what to do for them. Therefore certain men were assigned to this special branch, many of whom had previously confined their practice to eye, ear, nose or throat surgery, or to dental work. The majority of them, I venture to say, had never done a plastic operation before the war began, and few had had a general surgical training. In consequence they knew nothing whatever of the subject, even from a surgical standpoint, so had to begin from the beginning, trying out and discarding method after method, until they found procedures which were practical. The opportunity of taking care of great numbers of facial defects during this time, developed a number of extremely skilful and able men in this branch of plastic surgery, and they have done magnificent work. Few of them knew even its principles to begin with, so of course had little knowledge of the literature of the subject. In consequence, discoveries and new methods have been reported, many of which are either modifications of some well-known method, or rediscoveries of methods long familiar to the general plastic surgeon. As a matter of fact, in spite of the vast amount of material available, there have been remarkably few really brand-new methods developed in plastic surgery during the war, except in the treatment of those defects associated with fractures and loss of substance of the jaws. In the care of these cases it was soon found that the coöperation of the skilled dental surgeon was essential. The true plastic problems in military surgery were found to be much the same as those which had been solved in civil practice.

I am struck each time I go through the wards of any large hospital by the fact that there are cases on every surgical service, both general and special,

which require the help and knowledge of the general plastic surgeon. These cases in the majority of instances are simply being carried along. I feel sure that the chiefs of the various services in every hospital would welcome the help of the general plastic surgeon and his organization, as soon as they realized what could be done for these difficult and trying cases, or at least they would be glad to "pass the buck" to the plastic service.

In the military service, in time of war, it seems to me that all cases requiring plastic work, irrespective of the location of the lesion, should be placed in hospitals established especially for general plastic surgery. If this could not be done, then the most effective way of taking care of these cases would be to have a general plastic service in every general hospital, under a properly trained man, to which all plastic cases should be transferred, regardless of the service on which they were originally admitted. I can say from my personal experience that there is very little likelihood of encroaching on other surgical fields. The majority of cases which come to me are referred, either by general surgeons, orthopædic or genito-urinary surgeons, ophthalmologists, rhino-otolaryngologists, obstetricians and dermatologists. Sometimes the gynæcologist will also ask for help in cases in which the transplantations are of a type with which he is unfamiliar. So it can easily be seen that plastic surgery, instead of taking away something that the other branches want, is simply helping them out, and closing a gap in the art and science of surgery hitherto unfilled.

Proficiency in plastic surgery, like every other special branch of surgery, can only be obtained by long and varied experience, and there is no short cut possible, although much time can be saved by proper instruction. In fact, this branch is particularly tedious as the results in many cases are obtained only after numerous operations, extending over long periods of time.

The teaching of this important subject has been neglected everywhere, and there is as yet, as far as I know, no department equipped for the proper instruction of plastic surgery as a whole, in any American or foreign university. In fact, in many class "A" medical schools the subject is hardly mentioned, if at all, in the surgical course. The ignorance of the profession at large as to the scope and possibilities of plastic surgery is appalling, and no medical school has the right to graduate doctors without some instruction in this subject.

How is the best way to go about the teaching of plastic surgery? My experience when dealing with students is to carry out a program somewhat as follows: During the third year, give a short series of lectures, which in a general way will cover the entire subject. This is best done with the assistance of numerous lantern slides to illustrate plastic problems and the procedures used to solve them. Didactic lectures in surgery are of little value as a rule, but the excuse for this series is that it will show the students the scope of plastic surgery as a whole, and give them an opportunity of knowing what can be done in this field. During the fourth year, plastic surgery should be given as an elective course, and those interested in the

subject should be given every facility in the plastic clinic of the out-patient department to study the treatment of wounds, and carry out the various simple plastic procedures which can be done there. During this trimester the fundamentals of plastic surgery should be systematically taken up by means of conferences and demonstrations on patients. All the cases which require hospital treatment, and which are admitted through the plastic clinic, should be carefully examined, the possibilities discussed and the methods of treatment explained. When these cases come to operation, the students should be present, and should be able to follow the after-treatment in the wards. Even the little the students get in the elective trimester is of great advantage to them in whatever branch of work they subsequently take up, as they seem to absorb something which is lacking in the other surgical courses. I say this advisedly, as many of the men who have taken this course tell me that it has been of the greatest help to them in their work after graduation. An adequate number of ward beds in the hospital should be assigned for the plastic service, and as many house officers as are needed. These house officers should be selected from graduates of class "A" schools, who are interested in the subject. They should assist in the operating room on plastic cases, and in due time should be given operative work under supervision. They should look after all plastic cases in the hospital, conducting the post-operative treatment and dressings under the personal direction of the plastic surgeon in charge. The house officers should also serve in the plastic clinic of the out-patient department.

A service of this kind would be of great use to a man going into other branches of surgery, as it would give him a point of view, and a knowledge of the shifting and handling of tissues, and of the treatment of wounds, which at present is unavailable elsewhere.

It is now a generally accepted fact that "an adequate practical training in the principles and practice of general surgery" is necessary as a preparation for any real surgical specialty. This is particularly important for one who desires to specialize in plastic surgery, and consequently makes its final teaching a post-graduate subject. Post-graduate students should be carefully picked, and only those who show special aptitude for the work should be allowed to take the course, as it is impossible to make a plastic surgeon out of a man who has no flair for it. The post-graduate student should have the opportunity of working in the out-patient department, the privilege of the operative clinic, with the expectation of assisting the operator and receiving personal instruction in operative technic, and eventually be allowed to operate under the eye of the chief. He should have the privilege of following the cases in the wards and of studying post-operative treatment, and the chance for clinical and experimental research on plastic problems. He should have the facilities to study the pathological material removed at operation. Men of special ability should be taken into the house on the plastic service, and be given every opportunity to develop. The course should be at least one year, and preferably two. Instruction in plastic surgery on the cadaver,

except for anatomical relationship, is of little value unless the student understands the circulation of flaps, the behavior of scar infiltrated tissue, and the various problems of skin, fat, fascia, bone and cartilage transplantation.

Operative work in plastic surgery is of great importance, as it is in every branch of surgery, and should be carefully taught. However, in this work too much emphasis can not be laid on the cultivation of sound surgical judgment, and on the importance of careful examination and study of the various possibilities and procedures which may be beneficial in each individual case, as it is seldom that we find two cases exactly alike in plastic surgery. An unnecessary or ill-considered operation may completely eliminate the chance of good ultimate result, and it is the ultimate result we must plan for, and not the immediate relief of the condition. I have seen, and I am sure that many who hear this have also seen, plastic operations done by splendid general surgeons, which seemed perfect when they left the table, but those of us who have been able to follow some of these cases afterwards can tell of complete failures, and the suffering and prolonged convalescence of the patients, and of resulting conditions even worse than before operation. This can be accounted for in many instances by the lack of judgment and training in plastic problems, and by the desire to do too much at one time. When such cases do finally drift to the plastic surgeon, he is terribly handicapped by the fact that all the tissues which might have been used to advantage have been wasted, and by the lowered resistance of the patient. I know whereof I speak, for many of these cases come to me, and I have even witnessed the original operation on some of them, and felt sure when it was done that it would be a failure.

I do not want you to understand from what I have said that the plastic surgeon always gets a perfect result, as the man who never has a failure in any branch of surgery, either does no work, or stretches the truth. I do insist, however, that these difficult problems can best be solved by the trained plastic surgeon.

The knowledge of how to care for large unhealed defects and how to prepare them for contemplated plastic work is very important, although it has been said by those who should know better, that the treatment of wounds is a waste of time for the plastic surgeon and is out of his field. Of vast importance also is the proper preparation of scar infiltrated tissues, and the encouragement of nature, our greatest ally, to give us her generous help to a greater degree than usual, as attention to these details will often materially change the entire aspect of a plastic problem, and give us a better result than could have been anticipated.

In addition to his other qualifications the plastic surgeon must have originality and infinite patience; he must be an optimist, and more or less of an idealist, and he must have a far vision. He must also have a full measure of sympathy, as there is no branch of surgery, except possibly orthopædics, in which patient and surgeon come into such intimate contact over such long

periods of time as in plastic surgery, and in which the personal element enters so much.

Until some such plan as I suggest is adopted, patients requiring plastic work cannot be given the best treatment, and little real progress will be made in the development of the subject. It will take years of plodding, as it has in the past, for those interested to get the fundamentals of plastic surgery, while these can be taught in a reasonably short time in institutions properly equipped for the purpose. I wish to reiterate that there is a crying need for a general plastic surgeon in every large hospital, and also for the comprehensive teaching of plastic surgery in the medical schools. I feel this is bound to come. The question is, which school will see the light first, and start such a course under the direction of a trained general plastic surgeon and provide him with every facility necessary to develop and teach this important and fascinating subject.

THE TREATMENT OF ANTHRAX INFECTIONS*

By Alexius McGlannan, M.D.

of Baltimore, Md.

Anthrax forms a small but distinct professional risk to workers in hair and bristles. (.296 and .029 per cent., respectively, Page, Journal of Hygiene, vol. ix, 1909, p. 396.) It is also found occasionally among those people whose occupation brings them into direct contact with living or dead animals. It has come into prominence lately because of the danger of its dissemination through the use of infected brushes.

The serious and often fatal disease is quite common among animals, except in those countries where special precautions are taken to prevent the spread of the disease and to secure proper disposal of infected carcases. One of the many brilliant results of Pasteur's work lives in the relative freedom from the disease existing among the animals of France. From the animals infection reaches man by way of the highly resistant spores which contaminate the crude hides and hair of commerce, as well as the carcases of animals dead from the disease. Infection may be carried by the worker in one of these industries to individuals not otherwise exposed.

The usual portal of entry in human beings is through an injury to the epidermis. In one type, the wool sorter's disease, infection takes place by inhalation of the bacteria; and there is an intestinal type in which it is probable that the food is contaminated with the spores, most likely from dirty hands. My experience is limited to cases of cutaneous anthrax.

The skin lesion begins as an insignificant wound or abrasion through which infection occurs. A period of incubation, varying in length from a few hours to three days, is followed by local burning or itching and the development of a papule having a bluish-green centre. This lesion and the symptoms resemble those following an insect bite. The papule soon becomes vesiculated, the contents of the vesicle being hemorrhagic or serous. The vesicle breaks down and forms an erosion in which a purplish black area of leathery necrosis is set into the papule and separated from the red indurated rim of the lesion.

The anthrax papule and pustule is relatively painless, a feature which distinguishes it from furuncle and carbuncle.

The transition from the primary papule to the malignant pustule may occur in a few hours, or it may be possible to separate the progress of the lesion into three stages, which occupy from four to six days for complete development. (Graham and Detweiler, J.A.M.A., March 9, 1918, vol. lxx, p. 671.) (Lecene, Precis de Path. Chirurg., vol. 1, p. 101, Masson & Cie, Paris, 1920.)

1. The period of incubation lasting from two to three days.

* Read before the Southern Surgical Association, Memphis, Tenn., December, 1922.

2. The development of the papule and vesicle, lasting from twenty-four to thirty hours.

3. The stage of central necrosis with local induration, circumscribed œdema and vesiculation, lasting from one to three days.

In man usually there is a vigorous local reaction to the infection which may result in a distinct tendency for anthrax to remain localized. In rare instances after ten days, spontaneous demarcation and sloughing of the gangrenous pustule may occur, leaving an ulcer which heals slowly.

Often œdema develops about the pustule and spreads rapidly. The extent of œdema depends largely on the character of the tissues in the neighborhood of the primary lesion, and usually resembles a diffuse cellulitis with many blisters on the surface. The lymphatic vessels are inflamed and the draining lymph-nodes become swollen and indurated. The development of a localized pustule indicates a degree of resistance to the bacteria while a widespread œdema is evidence of failure of the tissue to prevent the advance of the infection. However, the bacteria may pass directly from the pustule into the blood and give rise to a septicæmia.

There is some controversy regarding the immediate effects of anthrax inoculation. Hiss and Zinsser (Text Book of Bacteriology, New York, 1916) inoculated the tails and ears of guinea pigs and were unable to prevent general infection by immediate amputation. The observers conclude from these and other experiments that, although the bacilli are not demonstrable in the blood until just before death, they nevertheless invade the blood and lymph streams immediately after inoculation and are conveyed by them to all the organs. The bacilli proliferate at the point of inoculation and probably in the organs until the resistance of the infected animal is entirely overcome. At this time the bacilli are able to grow in the blood stream.

Other experimenters contend that cutaneous anthrax always begins as a local infection with the bacteria confined to the lesion or its immediate vicinity. The clinical course of many cases, particularly those showing an indurated pustule with little or no surrounding œdema, is evidence in opposition to the conclusions of Hiss and Zinsser. There may be some essential difference in reaction to various methods of inoculation, as there certainly is a difference in the susceptibility of various animals.

The method of action of the anthrax bacillus in the body is not as yet definitely known. Hiss and Zinsser suggest that death is brought about to a large extent by purely mechanical means, such as capillary obstruction. Boidin is credited by Lecene with having extracted from anthrax bacilli an endotoxin capable of producing local œdema when injected into animals. Hiss and Zinsser assert that neither a true secretory nor an endotoxin has been demonstrated for the anthrax bacillus, but admit that the clinical picture of the disease makes it impossible to conclude that such a poison does not exist.

Whether or not the disease is localized or general at its onset has an important bearing on the rational method of treating the patient. If there is a recognizable period in which the bacteria are confined at the point of inocula-

tion, complete excision of the primary focus during this period is the surest and most rapid method of preventing general infection. If on the other hand, the bacteria spread throughout the circulation at the moment of inoculation, systemic treatment by specific serum injection is the proper method.†

If the number of bacteria reaching the circulation is small and the active proliferation is limited to the region of the portal of entry, excision of this primary focus combined with injection of the serum into the blood appears to be a reasonable method of combating the disease at the time such relation of infection and resistance exists.

When extensive œdema, lymphatic enlargement and symptoms of general infection have developed serum therapy alone is indicated. At this stage of the disease nothing can be gained by excision of the primary focus, and much harm may be done by opening new avenues for extension by cutting into the infected area.

I have had opportunity to treat six cases of anthrax. All the patients recovered. In four the lesions were distinctly localized, in a fifth there was spreading œdema, and in the other case there were symptoms of general infection. All were cases of industrial anthrax. The credit for the good results obtained is due to Dr. Asa Wessels, physician to the factory, who recognized the lesions as soon as he saw the patients and promptly sent them for treatment. In all cases the anthrax bacillus was demonstrated in the lesion.

Regan (Amer. Jour. Med. Sciences, September, 1921, vol. clxii, p. 406) advises the use of the Eichhorn serum both locally and intravenously to the exclusion of all other forms of treatment. His reasoning is good and he shows the effectiveness of the method in the hands of Symmers and others. It may be that with the existing uncertainty regarding the mode of invasion by the bacillus, local and general serum therapy is the best means of treatment, although the good results obtained in our small series of cases seem to indicate the value of early, complete excision of accessible primary foci.

Case Reports.—Case I.—August, 1909. Circumscribed pustule on right arm. The patient was a white man, age forty. The primary smarting and vesicle were noted about forty-eight hours before he reported to the physician. The pustule was about three-eighths of an inch in diameter with a black centre and an indurated narrow red border. Anthrax bacilli shown on the cover slip. There was no swelling or tenderness of the lymph glands and no lymphangitis. Temperature was normal. Under ether the involved area was excised and the wound was left wide open. The patient returned to work in thirty-seven days.

Case II.—June, 1912. Circumscribed pustule on neck. The patient was a white man, age fifty-two. The lesion was nearly three days old when he reported for treatment. The pustule was about half an inch in diameter, with typical dark centre and red rim. Anthrax bacilli demonstrated in smear. There were no signs of lymphatic involvement, and no fever. Under ether the involved area was excised with the electric cautery. The patient returned to work in thirty-six days.

† Eichhorn, of the U. S. Bureau of Animal Industry, has developed a serum of great potency. Serum prepared by his method is now available through the commercial manufacturers.

Case III.—June, 1920. Circumscribed pustule right forearm. The patient was a white female, age thirty-five. The lesion had been present four days at the time of treatment. It was a typical circumscribed malignant pustule and the bacilli were recognized in the smear. There was no œdema about the pustule, and no evidence of lymphatic involvement. The temperature was normal. Under nitrous oxide the lesion was excised with the cautery. The patient recovered without any complication.

Case IV.—April, 1922. Circumscribed papulo-pustule on left arm. The patient was a white female, age sixteen. The lesion was three days old at the time of admission to the hospital. The eroded vesicle at the summit of the papule showed an area of dark necrosis about the size of a pin head. The bacilli were recovered from the lesion. There were no signs of extension beyond the immediate area of involvement. Under nitrous oxide the lesion was excised with the cautery. The patient recovered without any complications.

Case V.—March, 1911. Malignant pustule of right temple with œdema of the face. The patient was a white man, age sixty. The lesion had been present three days when he was admitted to the hospital. The pustule was small, about one-fourth of an inch in diameter and had a typical black centre without much induration at its border. The œdema was a little brawny and involved the scalp, the forehead, the eye-lids and the cheek. The glands of the neck were not tender, nor were they enlarged, and there was no evident lymphangitis. The bacillus was present in smears. The patient was kept in bed. The surface of the pustule was disinfected with pure carbolic and alcohol several times a day. The slough separated, the œdema gradually subsided, until on the sixteenth day there remained only the indolent ulcer which marked the location of the pustule.

Case VI.—May, 1920. Malignant pustule on the nose, general infection. The patient was a white man, age thirty-five. The primary lesion was a small pustule on the nose which had been present forty-eight hours. The black slough was partly separated. The entire face and both sides of the neck were greatly swollen and brawny. The œdema involved the scalp, closed the eye-lids and filled out the recession of the neck under the angle of the jaw. The lymph glands were swollen and tender. The temperature was 104. There was marked dyspnœa and the skin was purplish red in color. Blood cultures proved negative, but anthrax bacilli were recovered from the pustule by smear and by culture. A dose of thirty cubic centimetres of anti-anthrax serum was given intravenously. The pustule was kept covered with small sponges of gauze, wet with mercurachrome solution. In the next twenty-four hours considerable improvement took place in the general condition of the patient, but he still had fever of 102 and the œdema was very slightly diminished. Another 30 c.c. of serum was injected intravenously. The temperature fell to 99.8 in the next eight hours and gradually falling remained normal after the fourth day. The bacilli were found in smears from the pustule for five days, after which time they disappeared. The swelling of the neck subsided rapidly after the fourth day. The pustule gradually dried up and on the tenth day was represented by a small scaly area on the nose. The patient was discharged cured on the fourteenth day.

TREATMENT OF DIVERTICULUM OF THE ŒSOPHAGUS*

By Charles H. Mayo, M.D.
of Rochester, Minn.

Diverticulum of the œsophagus has long been known and described. The rarity, lack of examining facilities, especially before the utilization of the Röntgen-ray, have delayed a thorough understanding of the condition. Bell, in 1830, recommended and made an external fistula into the sac. Rokitansky, in 1840, described and made two classifications of diverticula of the œsophagus; first the pulsion or pressure sacs forced out from within, and second, those caused by traction. Kluge, in 1850, recommended extirpation. Zenker and Ziemssen, in 1877, described the condition often called the Zenker pharyngo-œsophageal diverticulum. It is probable that Nichaus, in 1881, made the first extirpation.

Diverticulum of the œsophagus, a disease of adult life, is more common than generally realized. If it were regarded as not uncommon, those causing symptoms might be discovered early when the sac is small or at least before it becomes intrathoracic. Almost all such patients observed in the Clinic have received treatment for throat trouble or difficulty in swallowing for a considerable period, and a large percentage of cases were unsuspected as such. In some instances the condition was believed to be due to stricture, benign or malignant. The pulsion diverticula are pushed out from within by violent peristaltic action at this the narrowest part of the canal behind the cricoid. The traction type of diverticula are small, and are situated at about the level of the bifurcation of the trachea; they are usually caused by the suppuration of infected glands. They are rare, being found most often at necropsy, and seldom cause similar symptoms. They probably occur under tension; some may be congenital but not progressive. Judd reports a case seen in the Clinic of congenital stricture of the œsophagus causing a diverticulum-shaped pouch in the upper œsophagus in a child of twenty months who was cured by one dilatation.

All of the pulsion type of diverticula eventually become surgical with increasing severity of symptoms. They occur directly back of the cricoid cartilage on the posterior wall of the œsophagus at the juncture of pharynx and œsophagus. The weakness of the muscle and the covering at this point was noted by Lannier and by Hackerman, and is called the Lannier-Hackerman area. This is where evolution in changing the cephalic stomach and straight gut of invertebrate life to the anterior or vertebrate position, united the mouth with the œsophagus. A more common point for diverticulum to occur from congenital defect is where the intestine, in development, is inclosed within the abdomen at the umbilicus, known as Meckel's diverticulum. Once the œsophageal muscle is penetrated the sac gradually enlarges and develops a semi-

* Read before the Southern Surgical Association, Memphis, Tenn., December, 1922.

inflammatory or traumatic thickening of the fibrous tissue, at first in the middle line growing down in front of the spine, then bulging to the sides, and increasing usually somewhat more to the left. The large sacs grow into the mediastinum becoming intrathoracic; once there they increase more rapidly in size. Such sacs holding approximately a pint of material each have been seen in the Clinic. The wall of the sac, when large, is much thinner, the layer of mucous and fibrous tissue being about 0.15 centimetre thick and more fused. The small sacs are somewhat thicker in the fibrous layers, less in the mucous, and are more easily separated.

Symptoms.—The inception is probably rarely recognized as it is only possible when there is trouble in swallowing. Later irritation of the trachea and pressure on the recurrent nerves may lead to a troublesome cough. A varying degree of dyspnœa may occur with pressure, both conditions indicate a probable intrathoracic sac. The difficulty in swallowing (dysphagia) is much like that of stricture or malignancy.

Diagnosis.—The larger sacs become direct continuations of the upper œsophagus. It is difficult for sounds or probes, even if small, to be passed down the œsophagus without slipping into the sac. Dr. H. S. Plummer early developed the use of the silk thread guide. One end of about five yards of thread is swallowed and the other pinned to the clothing; usually within a few hours, or a day, the thread passes through the stomach and far enough into the intestines to stand traction. This method was first used by Mixter of Boston, as a guide in dilating strictures of the œsophagus. By threading the silk through the end hole of a sound or olive-tip probe and drawing it taut, the instrument, which previously is stopped at the end of the sac, now passes directly to the stomach along the thread guide. Plummer's suggestion, in addition to its common use, is to hold the thread less taut and to pass the probe to the bottom of the sac, then the distance the rod is elevated by tightening the thread, until the probe passes into the opening in the anterior wall and down the œsophagus, gives the exact depth of the sac. The thread is swallowed afterwards and passes through the intestine. The œsophagoscope is of some value, when available, in the examination of these cases. Such modifications as swallowing a chain, inserting a shot-filled tube with fluoroscopic examination, the Strauss method of measuring the capacity of sac, and dilatation by their distention with air blown rubber balloons passed empty on stomach tubes, are no longer necessary. While small sacs give trouble enough, patients with large sacs are often greatly emaciated by long starvation. In such cases a small stomach tube or a large catheter is passed down the thread and daily feedings given to prepare the patient for operation. This method of building up the patient is most satisfactory and makes gastrostomy by tube, recommended by König, Payr and Bevan, rarely necessary. The sacs, by enlarging the neck, are often of sufficient size to be seen. On compression the fremitus of air and fluids is distinctly felt and often the contents can be partly regurgitated into the mouth. The visual test, by röntgenograms, is of the greatest

value. The barium emulsion is given in amount sufficient to more than fill the estimated capacity of the sac and a röntgenogram made which gives accurately, depth, location and size, with experience in reading the plates, rendering other methods unnecessary. Considerable dilatation above a high stricture may occur, but the narrow line of barium is seen passing down through the œsophagus stricture below the pouch.

Treatment.—Several methods have been devised for removing or obliterating the sac. It has been suggested to pass the forceps to the bottom of the sac, open them, grasp the inside of the sac, draw it up like the finger of a glove, and push it down the inside of the œsophagus. This method does not appeal to a surgeon, as even the small sacs for which only it might be considered, are fairly well fixed by adhesions. External surgical removal in one or two stages, change of position, or obliteration are methods of choice. If a general anæsthetic is used the sac must be well emptied before operation. About thirty years ago while I was bringing up a large intrathoracic sac, the patient who was under a general anæsthetic, almost suffocated by the contents pouring into the trachea; he very nearly died later from bronchopneumonia. This experience led to the employment of a local anæsthetic, usually novocain, with some preliminary morphin, in practically all such cases.

According to the literature only a few hundred patients with diverticulum of the œsophagus have been operated on. Although the condition is benign the mortality has been as high as for more serious operations, such as malignant conditions in the abdomen. In one series of 200 collected cases reported in the literature there were sixteen deaths; in another of 109 cases, twelve deaths, and in one of 100, ten deaths after one-stage operations, and twenty-eight fistulas. Some time ago Doctor Judd presented a record of fifty-two cases operated on at the clinic with three deaths. The number of cases has now been increased to seventy-four without further mortality.

To me the size of the sac (seldom mentioned, in literature) is an essential point. All surgeons recognize the danger of acute infective conditions of the mediastinum. When the sac is small the surgeon has a choice of procedure, but a two-stage operation with the sac unopened at the first operation is necessary in those cases in which the sac extends to the thorax. In a few cases the cause of death is given as bronchopneumonia. I believe the condition may result when a general anæsthetic is given and the contents are expressed above the tracheal opening for aspiration into the lungs. Certain surgeons, notably König, recognizing the dangers of infection, cellulitis and the troubles of fistula, elevate the sac, fixing its fundus to the hyoid bone. Wildenberg, in seven cases reversed or changed the direction of the sacs, later removing three of them. Liebl fixed the sac to the skin incision, leaving it unopened. Ligating the neck of the sac, leaving it to slough out of the packed wound has been recommended by von Beck, who reported two deaths from pneumonia in seven cases. Goldman, at an early period, showed by this method 65 per cent. of fistulæ with septic cellulitis and slow healing. Murphy delivered the unopened sac through the incision, twisted it, and later amputated and closed the fistula,

a method used in one case in the Clinic with success. Girard, in 1896, invaginated the sac by suture, in two cases. Von Beck invaginated the sac by suture, double suturing and reefing to obliterate it without opening. Bevan, at the suggestion of Sippy, performed this operation evidently on a large sac, as he used two or three purse-string sutures to invaginate the outer part of the sac, and reefing sutures for the lower half, leaving the sac compressed at its attachment. His report suggests that one patient died because the sac invaginated into the œsophagus and being forced upwards by vomiting, caused suffocation from blocking the trachea. He mentions the advisability of removing half of a large sac and treating the remainder.

Bensaude, Grégoire and Guénaux believe the one-stage operation best, and that the two-stage is an unnecessary precaution. I believe, with Hartman, that the danger of such procedure is too great in the case of large sacs for the little that is gained in time.

The operative incision usually recommended is parallel to the anterior border of the sternomastoid muscle. A better incision is one made in the line of the natural crease of the neck, one-third being behind the anterior border of the sternomastoid, and the skin and platysma muscle dissected both ways from this line; this affords a blunt dissection with hardly a vessel to ligate. With blunt retractors the sternomastoid and omohyoid muscles, the internal jugular vein and common carotid artery are drawn back; anteriorly the sac is seen just behind and extending below the cricoid cartilage. In one of my earlier cases I deemed it advisable to pass a ureteral sound through the mouth into the œsophagus and to push the sac into the incision, an unnecessary procedure, but one recommended by Deis. Bartlett suggests a method to identify the sac which I have not as yet had opportunity to test. With incision and dissection complete to the region of the diverticulum, the patient being under a local anæsthetic, is instructed to close the lips and distend the mouth and pharynx with air, and thus distend the sac. This is a simple procedure and well worth trying. The sac is lighter colored than the surrounding tissues and has a small plexus of veins over it. Carefully held by forceps, blunt dissection separates it from the tissues in contact, and this is facilitated by a piece of gauze held in artery forceps. Large sacs are drawn up from their intrathoracic position with but little added difficulty, care being taken not to open or injure by rough pinching with forceps.

In both small and large sacs there is little difficulty in amputating and suturing at the juncture with the œsophagus, using two rows of chromic catgut and a small soft rubber drain. The technical difficulties are not great. Gauze, often mentioned as a drain, should not be used in a suture case, on account of the added danger of fistula.

Large sacs should be delivered unopened, packed around with a layer of gauze, or placed within a soft rubber drain to prevent healing to the incision and skin, and should be amputated and closed by suture in from ten to twelve days.

In the period between the first and second stages of the operation, the mediastinal space becomes closed and protected by granulation tissue. I believe that the success and low mortality shown in the treatment of an unusually large number of these patients during the last thirty years justifies the safety of the method and this additional report concerning it.

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THE METASTASIZING TENDENCY OF ŒSOPHAGUS CARCINOMA

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Considerable attention has been given in the last two decades to the question of the radical surgical treatment of œsophageal cancer, and successful resections have been reported in the recent past (Torek,[1] Zaaijer,[2] Lilienthal,[3] Küttner,[4] Hedblom[5]). One of these cases has since succumbed to a recurrence of the growth (Lilienthal[6]).

It is our purpose to consider the tendency of this neoplasm to form metastases. If this occurs early in most cases it would seem futile to attempt to devise methods for the radical operation, a procedure which must always have an immediate mortality. One would hardly be justified in subjecting a patient to an operation which would be quite apt to cause his death, and which if successful would in all probability only substitute for an earlier death by starvation, perforation, etc., a somewhat delayed death by the growth of metastases.

But there has been for many years a fairly general belief, expressed by Förster and Billroth (quoted by Kraus[7]), that carcinoma of the œsophagus is not prone to metastasize early (Sauerbruch,[8] Guisez,[9] Meyer[10]).

On the other hand, Ewing[11] writes that these tumors form early and extensive metastases. McRae,[12] with a small series of autopsy cases, says that metastases are found comparatively seldom only because the patients die too early in the course of the disease or else the metastases are overlooked post-mortem. Kraus (*loc. cit.*) states that the opinion of Förster and Billroth is controverted by the contributions of Petri, Zenker and Colle, reporting metastases, in their respective series, of 59.5 per cent., 60 per cent., and 62.5 per cent.

Unanalyzed figures from post-mortem statistics have only a limited clinical application. We are less interested in the final condition than in the condition when the diagnosis can first be made. If it were only possible to know to what extent metastases were present when the respective patients began to suffer from dysphagia, we would have a much more valuable insight into the matter.

However, we may compare the figures quoted by Kraus to corresponding figures for carcinoma of the stomach, and we will then find that they really indicate that œsophageal cancer is not particularly prone to metastasize. Konjetsny[13] says that cases dying from carcinoma ventriculi are only in exceptional cases free of metastases, quoting Redlich with 84 per cent. metastases in 178 cases, and Feilchenfeld reporting 85.8 per cent. metastases.

In an extensive study Kitain[14] found 68.5 per cent. of œsophageal carcinoma showed metastases, but excluding the local metastases in the

adjacent lymph-nodes the figure is 46.4 per cent. In the same series cancer of the stomach showed 82.1 per cent. metastases, which figure was reduced to 71.4 per cent. by omitting the regional lymph-node metastases.

Similar findings are reported by Von Mielcki,[15] and we have been unable to find any series that did not show for the carcinoma of the œsophagus a definitely less pronounced tendency to metastasize than gastric carcinoma. The *possibility* of metastases from a cancer of the stomach is not a contra-indication to operation. Simply because the cancer has existed for a considerable time the medical attendant does not decide that the case is hopeless, assuming that metastases have probably occurred. Bearing in mind the comparative figures for œsophagus and stomach, one would hardly expect that the possibility of metastases in carcinoma œsophagi would be advanced as a contra-indication to operation. And yet that is what is being done in some of the best clinics of the world, the patients often being comparatively young men in good condition, free of any evidence of secondary growths.

In 75 cases of carcinoma œsophagi Sebening[16] found 72 per cent. were free from organic metastases. Hampeln[17] found in not a single one of his 60 autopsy cases organic metastases, except where the tumor had invaded the stomach or pharynx. Since our study was completed an article has appeared from the Eiselsberg Clinic in Vienna in respect to 132 cases of carcinoma œsophagi, in which 66 per cent. were free from any metastases (Starlinger[18]).

Our study concerns 70 fatal cases of carcinoma of the œsophagus at the Franz Josef Hospital in Vienna. They have been separated, according to the pathological picture, into the following classes:

I. Local; carcinomas that show no metastases.

II. Metastatic in regional lymph-nodes, this including secondary growths in the œsophagus itself, in the retro-œsophageal nodes and adjacent nodes of the posterior mediastinum, and nodes around the cardia.

III. Metastatic in more distant lymph-nodes or in other organs.

Group I included 45 cases, a percentage without any metastases of 64 per cent., agreeing remarkably closely with Starlinger (*loc. cit.*). Group II had 4 cases, or 6 per cent. This gives 70 per cent. of our cases free from distant or organic metastases, as compared with Sebening's (*loc. cit.*) figure of 72 per cent. The evidence seems plain that even up to the termination of life, œsophageal cancer shows a rather limited metastasizing tendency.

In 59 cases we were able to determine from the clinical histories the duration of the symptoms referable to œsophageal disease. In two cases the period was zero as there was never any manifestation of the cancer, and they came to autopsy undiagnosed. This is by no means a novel occurrence and emphasizes the fact that in all cases the beginning of the disease doubtless antedated the onset of symptoms by a considerable period. However, the average duration of symptoms was 5.2 months.

Of 39 cases without metastases the average duration of symptoms was 4.84 months. Two cases had symptoms one year or over and ten others

six months or over, and all were free of metastatic growths. We may directly conclude that in the majority of cases early in the course of the complaint, carcinoma of the œsophagus is a local disease.

Study of the metastasizing tendency according to the location of the tumor in the upper, middle, or lower portion of the œsophagus did not reveal any facts of significance. We had, however, only four cases of cancer of the upper segment.

As previously intimated, we are most of all anxious to know just how many of these cases have metastases early in the course of their complaint. As more cases are operated on, this problem can be more accurately worked out. In our series four patients underwent radical operative treatment for carcinoma of the thoracic œsophagus. In all four it was possible to resect the growth, but none lived more than a few days after operation. Operative record and autopsy showed that two of the cases with a duration of symptoms of eight and ten months, respectively, were free of metastases. Two others with duration of symptoms of one and five months, respectively, showed metastases in regional lymph-nodes. In one all the metastases were removed at operation; in the other a cancerous lymph-node was found post-mortem at the diaphragmatic hiatus.

In addition to these four cases there were a number of other patients whose lives terminated not as result of the carcinoma *ex ipso*, but because of failure to recover from operation, namely, gastrostomy. These can by no means be regarded as early cases. Often the operation was done on patients who without it would have lived but a few days. The very fact that they were unable to survive such an operation is an index to their condition. However, we may believe that on the average they represent a somewhat earlier stage than the main body of the cases and definitely earlier than the group who survived gastrostomy and lived for some time nourished through the stomach fistula.

In our series there were 42 gastrostomies done. Of these, 28 lived *less* than 20 days after operation, an average of five and three-fourths days, while 14 lived *more* than 20 days after operation, an average of seventy-four and three-fourths days. The 28 cases fall into the pathological groups as follows:

I, 75 per cent.; II, 7 per cent.; III, 18 per cent.; compared to the 14 cases that survived gastrostomy for a considerable period: I, 57 per cent.; II, 0 per cent.; III, 43 per cent. Admitting that our series is small, yet we believe that these figures, which speak for themselves, are extremely significant. The second group outlived the first group by 69 days, by which period the percentage of cases showing general metastases is changed from 18 per cent. to 43 per cent. We can well realize wherein Willy Meyer spoke wisely when he said [19] that carcinoma of the œsophagus is to be treated as an emergency case and that there is no time to be lost in its accurate diagnosis and surgical treatment.

CONCLUSIONS

1. In 70 fatal cases of carcinoma of the œsophagus, metastases were present in 36 per cent. In 6 per cent. the secondary growths were limited to the regional lymph-nodes. This indicates a limited tendency to metastasize.

2. The average duration of symptoms, 4.8 months, in the patients who died without metastases indicates that in the majority of cases ample time is given for diagnosis and treatment before metastasis occurs.

3. However, the striking change for the worse in the pathological picture during the average of 69 days by which the group that survived gastrostomy outlived the group that succumbed thereto, gives warning of the speed with which metastases develop in a somewhat advanced stage of the disease.

4. Irrespective of the duration of the disease, the possibility of metastasis formation, without definite evidence of same, should not be considered as a contra-indication to radical operation.

This work was done with the helpful coöperation of Prof. Dr. Stoerk, Professor of Histo-pathology at the University in Vienna and Prosectur of the Franz Josef Hospital, and Hof-rat Prof. Dr. G. Lotheissen, Professor of Surgery at the University in Vienna, to both of whom I herewith wish to express my thanks.

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PAPILLOMA AND ADENOMA OF GALL-BLADDER*

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Benign neoplasms of the gall-bladder have been regarded as of rare occurrence, the vast majority of tumors which have been observed in this organ and reported being of malignant type. A search of the literature reveals a paucity of articles dealing with or descriptive of benign tumors of the gall-bladder. Sutherland [1] in 1898 reported an adenomyoma; Ringel [2] in 1899 a papilloma; Stanmore Bishop [3] in 1901 described an unusual, innocent growth the size or a child's head, most probably a papillo-adenoma; A. W. Mayo Robson [4] in 1905 an adenoma; Mayer [5] in 1911 reported the transformation of the gall-bladder into a papilliferous tumor; M. Dominici [6] in 1911 reported a diffuse papilloma involving the entire mucous membrane of the gall-bladder and give a resumé of the literature up to that date. In 1911 Sand and Mayer [7] collected eight cases of papilloma. Irwin and McCarty [8] in 1914 reported the finding of one or more papillomas in 85 of 2168 gall-bladders, and in 1915 C. H. Mayo [9] reported 107 cases of papillomatous disease in 2538 cholecystectomies. The recent text-books and monographs on disease of the biliary tract either do not mention the incidence of such tumors in the gall-bladder or else dismiss the subject with the statement that they are of rare occurrence, while the description of benign tumors of the gall-bladder occupies but small space in the works on pathologic anatomy.

Papillomas, especially of the villous type, occur on the mucosæ with comparative frequency, particularly in the gastro-intestinal tract and are usually found in the course of chronic irritation, either mechanical, chemical or infective. The gall-bladder being a common site for chronic infective disease shows not infrequently the presence of such tumors when routinely subjected to microscopical study.

The adenomas are usually regarded as the best example of Cohnheim's theory of tumor genesis and the fœtal types are readily explained by this hypothesis. So far, adenoma of the fœtal type has not been observed in the gall-bladder while the adult type has been described by several observers.

The fact that only in exceptionally rare instances have the tumors given rise to symptoms *per se*, the clinical aspect being that of chronic cholecystitis and the microscopical picture that of chronic cholecystitis plus the presence of unsuspected tumor, would seem to indicate rather conclusively that the neoplastic development was secondary to the irritation of a chronic infection.

Both tumors, papilloma and adenoma, occur with and without the presence of stones, and ordinarily there is no correlation between the presence of the tumor and clinical symptoms.

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In 288 cholecystectomies done between July 31, 1915, and October 1, 1922 and subjected to routine microscopical examination, eight presented benign tumors, five adenomas and three papillary adenomas. In the five adenomas the tumor was single and small, in two of the papillary adenomas a large portion of the mucosa showed multiple papillary outgrowths while in the remaining papillary adenoma the mass filled the gall-bladder. In seven of the cases gall-stones were present, there being none in the case presenting the largest tumor growth. In seven in which the gall-bladder wall was sectioned and examined, chronic cholecystitis was present. The youngest patient was 31, the oldest 63, average age 48.3 years. All the patients were females; this doubtless is to be explained by the greater frequency of gall-bladder disease among women than among men. Seven of the eight, including the case in which no stone was present, gave a history of colics and all had suffered for years, from four to twenty, with digestive disturbance.

The clinical picture presented in all of the cases was that of cholecystitis and cholelithiasis and the findings at operation revealed that the symptoms in seven were correctly ascribed to cholecystitis with calculi while in the eighth the tumor was largely responsible for the appearance of symptoms. The case is of sufficient interest and rarity to merit a detailed report:

Case Report.—Female, white, age fifty-eight, came under observation first in August, 1919. Her father had died at the age of seventy-four with cancer of pancreas: family history otherwise negative. Her only severe illness up to the inception of the present had been typhoid fever at thirty-eight. She was married, had had no children and had passed the menopause at forty-seven. Her present trouble began in 1915, with an attack of pain under the right costal margin accompanied by chill and fever. She had similar attacks in 1916, 1917, 1918. During these years and for many preceding the onset of colic she had digestive disturbance, characterized by fulness after eating, gaseous distention and abdominal discomfort. Six weeks before coming to the infirmary she had a severe attack of colic requiring opiates for relief, followed by chill, fever and jaundice, the illness confining her to bed during this period of time.

Physical examination showed the skin and mucosa pale with a distinct icterus present. Temperature normal, pulse 84, cardiac dullness one-half inch outside nipple line with sounds distinct and regular: no murmurs present. Blood pressure 158–92. Lungs negative. Abdomen showed marked tenderness and rigidity under the right costal margin extending downward to umbilicus. Pelvis negative. Urine negative. Blood.—Hæmoglobin 80 per cent., red blood cells 4,080,000, white blood cells 12,200, polymorphonuclear neutrophiles 68, small lymphocytes 25, large lymphocytes 6, eosinophiles .5. Diagnosis.—Acute cholecystitis. At operation, September 2, 1919, the gall-bladder was found covered by the stomach, intestinal and omental adhesions; upon separating these the wall and mesentery of the colon were found thickened and indurated, as was the liver tissue adjacent to the gall-bladder. The latter was thick-walled, rigid and apparently distended; upon introduction of trocar no fluid was obtained. Upon incising the gall-bladder it was found filled with a soft, friable epithelial mass, sessile in character and apparently involving the greater portion of its mucosa. A large amount of this was removed with the curette, bile appearing when the cystic duct was reached; no stones present. The whole picture appeared to me to be typical of a villous carcinoma, and the induration in the liver, wall and mesentery of colon was

interpreted as extension by contiguity and as rendering the case unsuitable for cholecystectomy. My conviction as to malignancy was so firm that none of the specimen was preserved for microscopical analysis. The gall-bladder was drained, the indurated area on colon and adjacent gall-bladder wall isolated by a cigarette pack and the abdomen closed. The patient was discharged from hospital nineteen days later and sent home with the diagnosis of advanced carcinoma of the gall-bladder.

I heard nothing further from her until in November, 1920, thirteen months later, when another patient from the same community, to my great surprise, told me that she had lost her jaundice, had gained in weight and strength and regarded herself as well. I saw the patient again July 8, 1922 and obtained the following history:

After returning home in September 1919 she continued weak and ill for four months, during most of which time she was in bed. The jaundice disappeared and the drainage wound healed. Beginning with January, 1920, she rapidly regained her health and strength and continued well until February, 1922, when she had an attack of colic followed by chill, fever and jaundice, being confined to bed for two weeks, all symptoms disappearing by the end of the fourth week. She then remained free of symptoms until May 28th, when she had another colic followed by chill, fever and jaundice and had been confined to bed until coming to the infirmary July 8th. Her weight was greater than at time of operation in 1919: pulse rate and temperature normal, heart and lungs negative. Distinct jaundice was present. Right upper rectus scar in good condition: slight tenderness on deep pressure under right costal arch, slight rigidity, no palpable mass. Blood showed—hæmoglobin 85, red blood cells 4,770,000, white blood cells 10,500, polymorphonuclear neutrophiles 64.5, small lymphocytes 31.5, large lymphocytes 4. Urine showed a trace of albumin, much bile, occasional hyaline cast, four to ten blood cells and three to five leucocytes to the one-sixth field of the microscope.

Judging from her history subsequent to the operation in 1919 and her improved general physical condition it was evident that the conclusion as to the presence of malignancy was erroneous. It was now believed that the tumor observed in 1919 was a villous papilloma, but we were at a loss to explain the origin of the two subsequent attacks of colic; were they due to extension of the tumor, to adhesions or to common duct stone?

She was operated on July 12, 1922, with a diagnosis of common duct obstruction. The scar of former operation was removed and the abdomen opened, finding the stomach, duodenum and colon adhered to under surface of liver, and with the latter to the abdominal wall. Upon separating these, the gall-bladder was found to have disappeared, there being no visable vestige of it or the cystic duct. The common duct was enormously distended, no stones could be felt and the introduction of an aspirating needle into the duct failed to show the presence of fluid. The common duct was incised over the point of greatest enlargement and a mass of what appeared to be epithelial overgrowth, pale gray and cheesy in appearance, presented in the incision: the incision was extended and a large amount of this material removed, finding it to fill the common duct from the junction of the hepatics to the papilla of Vater. The growth sprang from the ductal mucosa at a point corresponding to the usual site of junction with the cystic duct, involving an area approximately 1½ inches long and ¾ inch wide. The attached portion of the growth was removed with the curette and scissors and the base cauterized with the actual cautery. The distention of

the common duct was such that the finger could be easily introduced into each hepatic duct and the tip of the finger readily entered the duodenum at the papilla of Vater. The duct was drained with a T-tube, the incision in same sutured with catgut and the abdomen closed, bringing drain out a stab wound to right of abdominal incision. The jaundice disappeared, recovery was uneventful and the patient was discharged from the hospital well on the twenty-third day. Microscopical diagnosis of tumor was papillary adenoma, non-malignant.

The case presents certain interesting points: the size of the growth in the gall-bladder, its rarity and the close resemblance of its gross appearance to that of villous carcinoma, a frequent type of malignancy in this situation, is a prominent one. The presence of digestive disturbance years before the appearance of the first colic would argue for the existence of a chronic cholecystitis antecedent to the development of tumor; certainly the presence of inflammatory infiltration at the time of the first operation complicated the picture and contributed to the difficulty of correctly interpreting it.

Another point of interest is the complete disappearance of the gall-bladder and cystic duct although at the first operation nothing further was done than a curettement of the villous mass. Again, the size of the growth in the common duct, the enormous distention of the latter, with the typical clinical syndrome of common duct obstruction, most commonly due to stone.

Finally, was the growth present in the common duct at the first operation, or did it extend along the mucosa by contiguity coincident with the obliteration of the gall-bladder and cystic duct, or did it result from contact implantation as is so often noted in papillomata of the urinary bladder?

Conclusions.—1. Benign tumors of the gall-bladder, notably papilloma and adenoma, are not so rare as formerly thought, occurring in the Mayo series once in every 23½ cases of cholecystectomy and once in every 36 cases of the series herewith reported.

2. The invariable presence of chronic inflammatory changes in gall-bladders containing such tumors would argue the importance of chronic irritation as an etiological factor in their development.

3. The overshadowing clinical picture is that of cholecystitis, there being no correlation of symptoms with the presence of such tumors.

4. The fact that such tumors occur in the course of chronic cholecystitis is an additional argument in favor of cholecystectomy.

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WHITE BILE IN THE COMMON DUCT*

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The term "white bile" is a misnomer; it is applied to the colorless liquid occasionally found in the obstructed common and hepatic ducts. Although the gall-bladder often contains a colorless liquid, such a liquid is only rarely found in the common and hepatic ducts. The origin and nature of this so-called white bile have long puzzled surgeons, but it has been quite generally believed that its presence indicates greater operative risk.

Kausch, in 1911, reported in detail a case of "white bile" in which he had operated, and reported thirteen other cases which he had collected from the literature. In none of these fourteen was the obstruction due to stone, and Kausch believed it unlikely that obstruction by stone would result in white bile. From a study of these cases he concluded that white bile is a secretion of the mucosa of the biliary passages which occurs with obstruction when the secretion of the mucosa of these passages is greater than its resorption. The biliary passages then become distended and the pressure in them gradually rises. When a certain point is reached, the direction of the flow in the liver is reversed, that is, the bile formed by the liver cells and the bile in the passages pass into the lymphatics and blood-vessels. As a result of this and the continued secretion of a colorless fluid by the mucosa of the biliary passages, the liquid in these passages becomes lighter and lighter, and finally colorless. Kausch recommended cholecystenterostomy for the condition.

In 1921, Rous and McMaster succeeded in producing white bile experimentally. They proved that it is the secretion of the mucosa of the biliary passages and occurs in obstructed ducts which are not connected with a functioning gall-bladder, that is, a gall-bladder which is concentrating its contents by absorption. In the dog and cat, the common duct is formed from three or more main hepatic branches, high in one of which the gall-bladder empties. In several cats and dogs and in one monkey, obstruction of the common duct, or of one or more of its hepatic tributaries, was produced in such a way that the gall-bladder still communicated with the channels in stasis. The stasis bile found later was heavily pigmented and syrupy, ropy, or tarry, according to whether the period of obstruction had been long or short. In several dogs, cats and monkeys, the common duct and the neck of the gall-bladder were obstructed, or one or more large hepatic ducts were tied and cut separately. The stasis fluid in these cases was at first brown, then green, but definitely less pigmented, and finally after ten or more days of stasis, became clear, and often completely colorless. In several dogs, a

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portion of the common duct was isolated by ligating and cutting it above and below. At various periods up to twelve days the animals were chloroformed and examined. The isolated segment was found uninflamed, but greatly distended in every case, and contained colorless, watery or mucinous fluid, identical with that mentioned. All of the animals had become jaundiced but none of the duct fluid was bile-stained. Cultures of this fluid were negative.

Berg, in 1922, in his monograph on the biliary system, expressed the opinion that white bile must be due to some cause other than obstruction, as, in a large number of cases, a similar obstruction produces dark, concentrated bile.

In the last four years 649 operations have been performed on the common or hepatic ducts at the Mayo Clinic. In this group were nineteen in which white bile was present; in nine of these, the obstruction was due to stone in the common or hepatic duct and in six to trauma at a previous cholecystectomy; in two the obstruction was due to carcinoma (one of the pancreas and one of the ampulla), and in one it was due to pancreatitis. In one case the white bile seemed to occur as a result of cholangitis.

The nine cases of white bile due to obstruction by stone in the common duct occurred among 361 cases of stone in the common duct, an incidence of 2.4 per cent. The six cases due to stricture occurred among thirty-three cases of complete stricture, an incidence of 18 per cent. The two cases in which the obstruction was due to carcinoma occurred among 108 cases of carcinoma of the pancreas and ampulla, in 1.8 per cent. The incidence in pancreatitis was not determined, as in most such cases there is no obstruction of the common duct.

Seventeen of our patients were intensely jaundiced at the time of the operation and there had been no recent decrease in the jaundice. One patient who was not jaundiced had a biliary fistula, but at operation retained colorless bile was found. The second case without jaundice presented interesting features. The patient had been having attacks of gall-stone colic for six months, but had not been jaundiced until the last attack which was three weeks before operation. He had only a moderate degree of jaundice and it had lasted only a few days. At the time of operation there was no trace of jaundice and no bile in the urine. At operation the gall-bladder was found to be greatly distended and there was a stone in the common duct beneath the pancreas, completely blocking the duct, which contained only clear watery fluid. Curiously the patient was not jaundiced as a result of the complete obstruction to the duct. The stone was removed and the opening in the common duct closed. The gall-bladder was removed and a tube stitched to the stump of the cystic duct. On the fourth day drainage of bile started. The patient left the hospital in good condition on the twenty-third day after operation but died nine days later. At necropsy acute hemorrhagic pancreatitis was found. The absence of jaundice with complete obstruction must have been due to the fact that the liver was no longer secreting bile, probably a very unusual occurrence.

It is not definitely known how quickly the contents of the common and hepatic ducts can become colorless. In our series of cases, the shortest period of continuous jaundice before operation was two weeks; the longest period was one year, the average duration sixteen weeks.

As we have mentioned, Rous and McMaster proved experimentally that white bile occurs only when the obstructed ducts are not connected with a normally functioning gall-bladder. Seven of our patients had had cholecystectomy elsewhere. Six of the remaining twelve were found to have marked cholecystitis at operation; two had acute empyema of the gall-bladder; one had a completely cicatrized gall-bladder; and three had greatly distended gall-bladders, in one of which were multiple stones. None of our patients had normal gall-bladders; in other words, they bear out the conclusions which Rous and McMaster made from their experimental work.

One case was very unusual. The gall-bladder contained green watery material while the common duct contained fluid which showed no trace of bile. The patient had been having gall-stone colic at intervals for a year, but had been jaundiced only two weeks. At operation marked cholecystitis was found. The common duct was twice normal size. The glands along the ducts were greatly enlarged. The explanation is that the gall-bladder was cut off from the common duct by the inflammatory process and the contents of the biliary passages became colorless before hydrops of the gall-bladder could be produced. A cholecystostomy and choledochostomy were performed. One hundred twenty cubic centimetres of bile drained the first twenty-four hours, 330 c.c. the next twenty-four hours, and 180 c.c. the next twenty-four hours. Bile appears in the ducts after drainage is established in a remarkably short time. In our cases in which drainage was established to the outside, bile appeared in the first twenty-four hours in all except one. This is the patient who had complete obstruction without jaundice. The bile did not drain until the fourth day. The common duct of one patient contained only colorless fluid; cholecystectomy and choledochotomy were performed and at the close of the operation, the drainage was bile-stained.

Hepaticoduodenostomy was performed in one case, choledochostomy in eight cases, cholecystostomy in three, cholecystostomy and choledochostomy in four, choledochostomy and cholecystectomy in two, and cholecystectomy with a tube sutured into the stump of the cystic duct in one case. In the nineteen cases there were four operative deaths, an average mortality of 21 per cent. One patient died of acute hemorrhagic pancreatitis after leaving the hospital, which is not considered here as an operative death. One of the patients who died had had cholecystostomy; the remaining three had had choledochostomies. Post-mortem examinations were obtained in three of these cases. In two, about 500 c.c. of blood was found in the peritoneal cavity; this was not sufficient to explain death, as both patients had been transfused after the operation. The bleeding was an oozing from all surfaces and not from any one blood-vessel. One of the deaths was probably due to shock caused by the sudden release of pressure in a completely

obstructed bile duct; the other two were probably due to insufficiency of the liver. The fourth patient probably died of insufficiency of the liver and uræmia. Necropsy was not obtained, but the blood urea the day before death was 176 mg. for each 100 c.c. While the operative mortality was high in this group of cases, it is probably no higher than it would be in a series of cases of complete biliary obstruction of the same duration with green bile in the common and hepatic ducts.

Loss of weight was a striking feature in the history of these patients. Often it suggested malignancy. One patient whose obstruction was due to stone, had lost thirty-two pounds in ten days, and a patient with a stricture had lost sixty-one pounds in one year. The average loss of weight was twenty-eight pounds. The average duration of the jaundice was sixteen weeks.

It cannot always be assumed that white bile indicates that the liver is not secreting. In fact, in our series, there was only one case in which the liver probably was not secreting bile. There are two reasons for believing that the liver does not necessarily cease to secrete bile; first, the elimination of bile in the urine would result in a decrease in the jaundice. Two of our cases were not jaundiced; the others had a good deal of bile in the urine, yet there had been no decrease in the intensity of the jaundice. Second, if the liver had ceased to secrete bile, it would hardly resume that function so rapidly after the establishment of drainage. As we have noted in one of our cases, the drainage from the tube in the common duct become bile-stained by the end of the operation.

It is a well-known clinical fact, that, if bile does not appear soon after establishing drainage of the common duct in a deeply jaundiced patient, the outlook is not good. Two of our patients who did not recover had slight drainage of bile for the first few days and then it stopped. One of the patients who recovered did not drain bile until the fourth day; it is possible that some of the bile was passing around the tube into the intestine, and yet no bile was found in the duct at operation. In view of what is known of a temporary cessation of function of other viscera, it seems possible that all hepatic function might be suspended for a time and still be entirely reëstablished later.

It is improbable that we shall ever be able to operate in this type of case without mortality. The patient who died of uræmia might have been saved by the better pre-operative treatment now in use. In our experience most of the deeply jaundiced patients have uræmic tendencies, as is shown by the high percentage of blood urea. This can often be corrected by increasing elimination.

We have seen what we have termed "liver shock" in certain cases of jaundice. It has seemed to come after sudden, complete and permanent release of pressure in the common duct. The fluid in the duct had been under great pressure and, as soon as the duct was opened, a great amount of fluid escaped immediately, filling the entire operative field. This reaction has occurred in cases in which the fluid in the duct was bile, and also in those

in which it was white. The shock has usually come several hours after the operation when the immediate effects of the operation had apparently passed. Whether this reaction may be due to congestion in the hepatic tissue, caused by the sudden entrance of a large amount of blood into the vessels as a result of the sudden release of pressure in the hepatic ducts, we do not know. In cases in which the bile was under great pressure, we have tried to release it gradually by suturing a tube into the duct, without allowing all of the fluid to escape, and clamping the tube as a control. The clamp is released for a few minutes at intervals for the first few days, in this manner gradually decompressing the liver. Just how much this will accomplish in these cases is uncertain. We have employed it a number of times and in each case there was complete freedom from post-operative reaction. The post-operative bleeding, so often seen formerly in these cases, seems well under control by proper preliminary methods.

Cases in which there is white or colorless fluid in the common duct represent a very serious surgical type. They are not, however, necessarily fatal, as the finding of this fluid in the duct does not mean that the liver is interfered with more than in any deeply jaundiced patient. The colorless fluid or so-called white bile is a product of the glands of the duct wall. It is secreted under sufficient pressure to continue to form, regardless of the secretion of bile from the liver, and it collects in the ducts only when the activities of the gall-bladder are destroyed.

REPORT OF CASES

CASE I (A260954).—Mr. G. M., aged fifty-one years, was examined February 20, 1919. Since August, 1918, the patient had had four or five attacks of severe pain in the right costal arch, referred to the back, and accompanied by nausea and vomiting, and residual soreness in the region of the gall-bladder. Moderate jaundice had accompanied the last attack two weeks before. He had lost six pounds in weight.

Examination did not reveal evidence of jaundice. The urine contained albumin 1, but was otherwise negative. February 27, 1919, choledochotomy, cholecystectomy and appendectomy were performed. A rounded stone, 2 cm. in diameter, was found in the common duct under the pancreas; it crumbled during removal. The gall-bladder, and common and hepatic ducts did not contain bile, but were filled with clear fluid. Pancreatitis 2 was noted. There were no stones in the gall-bladder, which was greatly distended. Although obstruction apparently was complete, the patient had not been jaundiced. A tube was sutured into the stump of the cystic duct. Bile did not drain until the fourth day when 210 c.c. drained, and on the fifth, 180 c.c. The stools were colored after the operation. The patient left the hospital the twenty-third day, and died the thirty-second, from acute hemorrhagic pancreatitis.

Comment.—This case is particularly interesting, first, because, although the duct was apparently completely obstructed, the patient did not have the ordinary clinical signs of jaundice. In view of the fact that there was no bile-stained fluid in the gall-bladder or ducts, it would seem that the obstruction of the ducts had been complete. We are unable to explain this unless the liver had ceased secreting bile. It is further noteworthy that although the patient seemed to be in good condition after the operation, there was no sign of drainage of bile from the duct until the fourth day, when it gradually increased. The inflamed pancreas was noted at operation, but there was no evidence of

hemorrhage into it or of fat necrosis. We are unable to explain how the patient could live for several days without liver function, and also why the pancreatitis which apparently existed at the time of operation did not clear up with drainage of the common duct.

CASE II (A262802).—Mrs. P., aged twenty-nine years, had had a cholecystectomy performed elsewhere in October, 1918, because of soreness in the area of the gall-bladder, and dyspepsia. As long as the bile drained the patient felt comfortable, but in January, 1919, the opening closed, and she became yellow and jaundiced. She lost thirty-two pounds in weight.

The patient was jaundiced at the time of the examination, and bile 3 was found in the urine. March 14, 1919, choledochostomy was performed. The common duct was distended and completely occluded. The patient died on the day of the operation. Necropsy revealed 500 c.c. of blood in the abdomen.

Comment.—Because of the deep jaundice and complete obstruction the patient was recognized as an extreme risk. An attempt was made to establish the flow of bile through the duct with the hope of making a plastic reconstruction later. Immediately after the operation the patient seemed to be in good condition. Within a few hours, she showed signs of shock, such as has been observed on sudden release of pressure in a completely obstructed common bile duct. All possible efforts were made to correct this, without avail. A transfusion of 500 c.c. of blood was given. Necropsy revealed nothing of significance except about 500 c.c. of blood in the peritoneal cavity. We believe, however, that such bleeding often occurs after operations on jaundiced patients and that it is not sufficient to explain the cause of death.

CASE III (A294436).—Mrs. C. C., aged forty-three years, was examined October 24, 1919. She gave a history of having had gall-bladder disease since 1903. Cholecystectomy had been performed elsewhere in August, 1918. Two months later persistent jaundice had developed. The patient lost twenty-five pounds in weight in fourteen months.

Examination revealed jaundice and bile 2 in the urine. November 4, 1919, hepaticoduodenostomy was performed. There was complete obstruction of the hepatic duct at the site of the cystic duct. No bile, but 200 c.c. of clear fluid was found in the ducts. The pancreas was normal. On the sixth day post-operatively there was slight drainage of bile from the wound and none thereafter. The patient left the hospital on the seventeenth day.

Comment.—One point of interest in this case is that she had been continuously jaundiced for about one year, and was deeply jaundiced at the time of operation. At operation the liver was found to be greatly enlarged and there was complete obstruction of the common bile duct at the site of the cystic duct. The operation consisted of hepaticoduodenostomy, and while there was some drainage of bile to the outside on the sixth day, this stopped very shortly, and the wound healed in a short time. Apparently all of the bile that was being formed by the liver had been taken into the general circulation for a year, but as soon as the obstruction of the duct was relieved and the normal bile passage established, the jaundice subsided readily.

CASE IV (A307822).—Mrs. M., aged forty-four years, came to the Clinic, March 2, 1920, with a history of having gall-stone colic three years. She was first jaundiced six weeks before. The jaundice had been continuous for two weeks. She had lost thirty-three pounds in weight.

At examination, jaundice grade 2 was noted. March 13th, cholecystostomy and choledochostomy were performed. The common duct and gall-bladder were greatly distended and contained only mucoserous liquid. One stone was found in the common duct, and one in the gall-bladder. The condition of the pancreas appeared to be malignant. The patient left the hospital the eighteenth day, and

was dismissed from observation March 10th, with bile still draining from the wound.

Comment.—The gall-bladder and ducts contained a clear, thick fluid. The day of the operation 45 c.c. of bile drained from the tube; the second day 300 c.c. drained and the third, 240 c.c. Apparently as soon as the clear fluid had escaped from the gall-bladder and ducts, the bile began to flow.

CASE V (A312770).—Mrs. F. K., aged forty-two years, was examined April 17, 1920. She had had gall-stone colic for two years. Jaundice had appeared after the last attack, two weeks before, and had persisted.

Jaundice grade 3, and bile 2 in the urine was found on examination. May 12th cholecystectomy and choledochostomy were performed. A large stone was found impacted in the ampulla of Vater. The common and hepatic ducts also contained a number of medium sized and small stones and thick mucus. At the close of the operation normal appearing bile was escaping from the drainage tube. The pathologist reported acute empyema of the gall-bladder with cholelithiasis and pancreatitis 2. Two hundred forty cubic centimetres, 300 c.c., and 300 c.c. of bile drained in the first three twenty-four hour periods respectively. No bile drained after the ninth day. The patient left the hospital the fourteenth day.

Comment.—This case is of special interest in view of the fact that although the patient was deeply jaundiced the condition had been present for only a few weeks. At operation a complete obstruction of the duct by a stone at the ampulla of Vater was found, and although the duct contained fluid which was not bile-stained it emptied, and the bile started draining as soon as the obstruction was removed.

CASE VI (A317871).—Mr. H. M. K., aged forty-nine years, was examined May 31, 1920. He had had gall-stone colic for six years. Jaundice accompanied the last attack which started nine days before. The jaundice persisted. The patient had lost thirty-two pounds in ten days.

Examination showed jaundice 3, and bile 3 was noted in the urine. June 7th partial cholecystectomy and choledochostomy were performed, and subacute cholecystitis with one stone blocking the cystic and common ducts was revealed. The walls of the gall-bladder were not very thick, the common and hepatic ducts were dilated, and the gall-bladder and common duct contained only a thin, watery secretion. Two hundred seventy cubic centimetres, 300 c.c. and 270 c.c. of bile respectively, drained in the first three consecutive twenty-four hour periods after operation. No bile drained after the fifteenth day. The patient left the hospital on the seventeenth day.

Comment.—This case is of special interest to us because the stone which obstructed the common bile duct also completely obstructed the cystic duct, and interfered with any functioning of the gall-bladder.

CASE VII (A317760).—Mrs. M. K., aged fifty-six years, was examined May 31, 1920. She had had stomach trouble since girlhood; and gall-stone colics with jaundice since May, 1919. Jaundice had been continuous for two weeks before examination. No loss of weight was noted.

At examination bile 1 was found in the urine, but no bile in the stools. June 10th choledochostomy and cholecystostomy were performed, revealing a single stone in the common duct, which was dilated. There was no bile in the ducts, but the gall-bladder was contracted. Two hundred ten cubic centimetres, 210 c.c., and 360 c.c. of bile drained in the first three consecutive twenty-four hour periods following operation. The patient left the hospital on the twenty-third day; at this time there was no drainage.

Comment.—Clinically, this case represented the ordinary case of common-duct stone, and so far as could be determined, there was no means of suspecting the presence of white bile. The clinical evidence of jaundice was not as com-

plete as in some of the other cases, although the obstruction of the duct was complete. The flow of bile was established almost as soon as the obstruction was relieved.

CASE VIII (A347053).—Mrs. G. W., aged fifty-six years, was examined January 21, 1921. She had had gall-stone colic for four years. Cholecystectomy had been performed elsewhere September 29, 1920, and drainage of bile had persisted. December 7, 1920, an exploratory operation was performed, but the results were unsatisfactory as the patient went into collapse on the table. Bile drainage persisted, and the patient had lost thirty-five pounds in weight.

At examination jaundice was not evident, and there was no bile in the urine. Pre-operative treatment was not given. January 31st choledochostomy was performed. There were multiple abscesses throughout the abdominal wall, the retained bile was colorless, and the hepatic duct contained stones. The drainage of bile increased with each successive twenty-four hour period. The patient left the hospital on the twentieth day. February 11, 1922, hepaticoduodenostomy was performed, but the patient died on the day of operation from hemorrhage.

Comment.—In this case the white bile was the result of stricture formation, which completely obstructed the duct.

CASE IX (A339670).—Mrs. M., aged fifty-five years, was examined November 2, 1920. For twenty-five years she had had attacks of severe pain in the upper abdomen accompanied by chills, and fever. Morphin was required for relief. Two years before, the patient became jaundiced, and this condition persisted in varying degree for eighteen months, then apparently disappeared for several weeks. Later it reappeared, accompanied by pain, and was still present at the time of examination. The patient had lost sixty-five pounds.

Examination revealed jaundice 3 +, with tenderness in the region of the gall-bladder, and albumin 3 with a trace of bile in the urine. The patient was sent home because of her poor condition, and calcium lactate was prescribed. She returned four months later, still jaundiced, and pre-operative treatment was instituted. March 31, 1921, cholecystostomy and choledochostomy were performed, revealing cholecystitis with cholelithiasis, biliary cirrhosis 3, pancreatitis 2. Moderate ascites was present, the liver was very large and the spleen could not be palpated. About 500 c.c. of gluey white fluid (white bile) escaped from the gall-bladder and common duct. Drainage of 180 c.c. of bile was noted the first day after operation, and the dressings were stained with bile 2. The second day 750 c.c. of bile drained and the third day, 420 c.c. The patient left the hospital on the twenty-ninth day, still jaundiced, with blood-stained bile draining.

Comment.—This case is one in which the jaundice had persisted for a long time, and at the operation, the gall-bladder and ducts were found to be greatly distended with a large amount of white bile. This is the only case in which ascites was present to any extent, and one of the possibilities is that the portal circulation may have been interfered with by pressure from the greatly distended bile ducts, as suggested by Kausch.

CASE X (A354710).—Mrs. R. W., aged thirty-four years, was examined April 7, 1921. Cholecystitis had been present eight years. In August, 1920, a cholecystectomy was performed elsewhere. Jaundice appeared eight days after operation, and was progressive. Forty pounds in weight were lost.

At examination the patient was jaundiced and bile 2 was found in the urine. A transfusion was the only pre-operative treatment given. April 13th choledochostomy was performed. The common duct contained colorless bile; much scar tissue was noted. Forty-five cubic centimetres, 60 c.c., and 90 c.c. of bile drained in the first three successive twenty-four hour periods, respectively. The patient died on the fifth day after operation. Necropsy revealed intra-abdominal hemorrhage.

Impaired liver function was probably the important factor in producing death.

Comment.—This case emphasizes the risk of operating on deeply jaundiced patients. The patient, except for the jaundice, was apparently in fair condition. Operative procedures were no more than was necessary to reëstablish the biliary flow. As occurs in a great many of such patients who do not recover, only a very small amount of bile drained at any time, but the amount was sufficient to show that the ducts and tube were not obstructed. The intra-abdominal hemorrhage in this case amounted to 500 c.c. During the five days after operation, the patient was given three transfusions of 500 c.c. each, which would more than offset the free blood in the peritoneal cavity.

Case XI (A357381).—Mrs. D. B. S., aged fifty-three years, was examined May 6, 1921. Pain had been present in the right upper quadrant for six months. The patient was first jaundiced twelve weeks before, and the condition persisted in varying intensity. The patient had lost thirty pounds in twelve weeks.

At examination jaundice 4 was noted and bile 3 was found in the urine. May 15th, cholecystostomy was performed, and an abscess in the gall-bladder, containing 30 c.c. of pus, was found and drained. There was marked biliary cirrhosis, and white bile escaped from the common duct. Stones were found in the common duct, and it was thought best to remove them at a second operation. The bile drained freely. The patient left the hospital on the twenty-ninth day. August 6, 1921, a second operation, choledochostomy, was performed, at which time stones were removed from the common duct. The patient was dismissed from the Clinic August 25, 1921.

Comment.—This case represents the value of the two-stage operation in cases in which the severity of the condition is recognized.

Case XII (A363696).—Mrs. J. D., aged fifty years, was examined July 5, 1921. She had been troubled by gall-bladder disease and colic for one year. Stools had been white for the last six months, and the patient had been jaundiced for one week prior to examination. The only previous operation was a uterine suspension. Seventeen pounds in weight had been lost.

On examination the patient showed marked jaundice, 3. Bile 2 was found in the urine, and pre-operative treatment for jaundice was given. July 12th cholecystostomy and choledochostomy were performed. Portal cirrhosis, slight pancreatitis, and very marked cholecystitis were noted. The gall-bladder was flaccid. The glands along the ducts were markedly enlarged, some green watery material was found in the gall-bladder, but no bile-stained fluid in the common duct, which was twice its normal size. The operator diagnosed the condition as cholangitis with cholecystitis. The drainage of bile in the first successive twenty-four hour periods after operation was 120 c.c., 330 c.c., and 180 c.c. respectively. The patient left the hospital on the twenty-third day after operation. No bile had drained from the wound since the thirteenth day.

Comment.—The explanation of the fact that there was bile-stained fluid in the gall-bladder and colorless fluid in the common duct must be that the ducts and the gall-bladder were separated by obstruction. This is the only case in which we were unable to determine the exact cause or the obstruction of the bile duct. It may have been due to the pancreatitis of the enlargement of the lymphatics. Although there was no bile in the common duct at the time of operation it nevertheless appeared from the drainage tube very shortly afterward. The patient was clinically well and the wound healed normally in the ordinary length of time.

Case XIII (A365515).—Mrs. M. C. B., aged sixty years, was examined July 21, 1921. Five months before, she had had a chill and fever with vomiting, followed by jaundice which persisted. She had lost seventeen pounds.

At examination jaundice 3 was present. July 30th choledochostomy was performed. The gall-bladder was contracted, and a stone and white bile were found in the common duct which was dilated and completely cicatrized. Biliary cirrhosis 3, enlargement of the liver 3, and pancreatitis 1 were noted. The dressings were bile-stained the first day. One hundred ninety-five cubic centimetres and 300 c.c. of bile drained in the second and third twenty-four hour periods following operation. The patient left the hospital on the fifteenth day. No bile drained from the wound after the thirteenth day.

Comment.—While this case is clinically one of painless jaundice, the cause of the obstruction of the common duct was a stone. The obstruction must have been complete in view of the fact that there was no bile in the duct at the time of operation. The gall-bladder was apparently completely destroyed by inflammation. The jaundice cleared up after drainage, so that it was evidently not the result of cirrhosis or pancreatitis.

Case XIV (A371864).—Dr. H. B. A., a man, aged fifty-six years, was examined September 12, 1921. He had suffered from gall-bladder disease for two years, and had lost sixteen pounds. He was jaundiced for three days before coming to the Clinic. Examination showed jaundice with bile 3 in the urine. Pre-operative treatment was given. September 27th, cholecystostomy was performed. One stone was found in the gall-bladder, the walls of which were thick. The common duct was greatly dilated and contained clear fluid. Obstruction of the common duct at the head of the pancreas, pancreatitis 3, and moderate biliary cirrhosis were noted. Sixty cubic centimetres, 120 c.c. and 270 c.c. of bile, respectively, drained in twenty-four hour intervals following operation. The patient left the hospital on the ninth day. The last dressing was removed October 19th, at which time bile drained from the wound.

Comment.—This case represents one in which swelling in the pancreas as the result of inflammation may have been sufficient to produce complete obstruction in the common duct. The inflammation apparently originated in the gall-bladder, which contained one stone, and very probably extended from there to the pancreas. We believe that the pancreas seldom becomes involved in inflammation to the degree of producing complete obstruction of the common duct, but undoubtedly it occurred in this case.

Case XV (A388643).—Mr. E. G., aged fifty-seven years, was examined November 18, 1921. He had had pain in the upper abdomen with fluctuating jaundice for six months.

At examination jaundice 2 was noted, and pre-operative treatment for jaundice was given. December 1st cholecystostomy was performed. White bile and stony fragments were found in the distended gall-bladder and common duct. Pancreatitis 4 and biliary cirrhosis 3 were also present. The drainage of bile in the first three consecutive twenty-four hour periods following operation was 980 c.c., 1600 c.c., and 1650 c.c. respectively. The patient died on the ninth day from insufficiency of the liver. Necropsy revealed carcinoma of the head of the pancreas.

Comment.—Complete obstruction of the duct with formation of white bile in this case was due to carcinoma of the head of the pancreas. Death was probably caused by liver insufficiency and malignancy in the pancreas.

Case XVI (A242658).—Mr. G. E. W., aged fifty-one years, was examined March 28, 1922. He had had stomach trouble for fourteen years. Eight and one-half years before, he began to have attacks of sudden pain in the epigastrium with bloating, and residual soreness requiring morphine. Recent attacks of pain localized in the right costal marginal area and were accompanied by chills and fever. Jaundice occurred with the last attack and persisted in a varying degree. There was no history of loss of weight. Appendectomy had been performed eight years before.

Pre-operative treatment was given. April 25th, choledochostomy was performed. The Mayo-Robson hepaticus drain was used. The gall-bladder was definitely inflamed, but contained no stones. The common duct was dilated, and when opened, watery, colorless bile, and considerable mucus gushed from it. A stone which was wedged at the ampulla was removed without difficulty. Biliary cirrhosis was present. Convalescence was uneventful. Two hundred seventy cubic centimetres of bile drained during the first twenty-four hours; 360 c.c. during the next twenty-four hours; and 450 c.c., during the next twenty-four hours. The tube came out on the seventh day. There was no drainage of bile after the eighth day.

Comment.—It was difficult to make a diagnosis in this case, in spite of the fact that there was eventually a complete obstruction of the common duct. In several instances when the chief complaint was gastric, we were unable to determine that the patient had enough trouble to warrant an operation for gall-bladder disease.

Case XVII (A376062).—Mrs. F. W., aged forty-eight years, was examined April 20, 1922. She had had gall-stone colic for twenty years.

August 3, 1921, cholecystectomy and choledochotomy were performed. The common duct was found to be distended and filled with stones. October 16, 1921, the patient had a chill and fever followed by jaundice which continued though the degree fluctuated. Since February the patient had had two attacks of colic. Loss of weight has been continuous (61 pounds in one year). April 28, 1922, following pre-operative treatment choledochostomy was performed. Hepatic cirrhosis 3 was present. The liver was large, firm, hard and granular, and oozed when it was touched. Many adhesions were noted. The common duct was large and dilated, and the distal part was apparently gone. No communication with the bowel could be located. On opening the common duct, about 180 to 240 c.c. of colorless fluid, with no suggestion of bile pigment, but containing considerable pus, escaped. It was believed that there was a stone in the common duct, but operation revealed none. A tube was placed in the duct. The patient did not improve. Sixty cubic centimetres of bile was drained in the first twenty-four hours, 60 c.c. in the next twenty-four hours, 90 c.c. in the next twenty-four hours, after which the drainage ceased. The patient gradually declined, and died on the eighth day. The blood urea was 176 mg. on the seventh day; the urinary output was satisfactory throughout. Necropsy was refused.

Comment.—The marked loss of weight in this case is characteristic of complete obstruction of the common duct. The case is also of interest because from the time of operation, although the patient seemed to be getting on satisfactorily, there was no increase in bile drainage and death ensued, apparently from insufficiency of the liver and uremia.

Case XVIII (A277704).—Mrs. H., aged twenty-seven years, was examined April 20, 1922. She had had an appendectomy five years before. She had complained of severe pain in the left upper abdomen, with belching, bloating, and vomiting, required morphin for relief, and followed by residual soreness. The first attack occurred during pregnancy; two more attacks occurred later. Slight jaundice accompanied each attack. October, 1921, cholecystectomy was performed elsewhere, but no stones were found. Bile drained for two weeks. In January, 1922, the patient began to be jaundiced, and the jaundice gradually increased in severity. In March, 1922, she had an attack of sudden, severe pain in the left upper quadrant, with rigidity of the left upper rectus, requiring morphin, and followed by soreness in the upper quadrant. The patient had lost thirteen pounds in three months.

May 10, 1922, choledochostomy was performed. Post-operative biliary cirrhosis was found. The liver was small. Adhesions to the hepatic duct were separated, and the hepatic duct opened. Watery fluid, without bile pigment, gushed from the duct. A small opening was made in the hepatic duct, a rubber catheter was inserted, and its end closed, thus producing a condition very similar to that existing before operation. The pressure was gradually released in an effort to stimulate the liver function. Four post-operative blood transfusions, 300 to 500 c.c. each, were given. Chills occurred for several months. September 27th, another operation was performed to reconstruct the common duct. A T-tube was inserted. Three hundred cubic centimetres, 380 c.c. and 380 c.c. of bile drained in three successive twenty-four hour periods following operation. The patient left the hospital on the thirteenth day and was dismissed from the Clinic, October 13th, carrying a T-tube.

Comment.—At the time of the reconstruction of the common duct the jaundice had almost completely subsided. This patient is now wearing a T-tube which will be removed in a few months.

Case XIX (A396281).—Mr. N. C., aged sixty-seven years, was examined June 29, 1922. He had had no previous diseases, except influenza in 1889. Three years before, cholecystectomy was performed elsewhere. He came to the Clinic because of jaundice, pruritus, and loss of weight. In September, 1918, he had an attack of pain in the upper abdomen, requiring a hypodermic; this attack was followed by soreness for several days. Three months later he became jaundiced and began to lose weight. His stools were white and he had no appetite. No stones were present at the time of the cholecystectomy in May, 1919. The jaundice cleared up in one month, and he began to gain weight and to feel well. In September, 1921, he again developed jaundice and lost forty pounds in weight; the jaundice persisted. For one month prior to examination, he had continuous dull pain in the epigastrium.

At examination, the patient was markedly jaundiced and bile 3 was found in the urine, and the stools were gray. July 24, 1922, choledochostomy was performed. Carcinoma of the ampulla was revealed, and the common duct was extremely dilated. The large and small intestines were very tense. Mucous-tinged, clear, colorless bile was found in the common duct. There was a movable, free growth in the ampulla.

Comment.—The extreme dilation of the common duct resulted from an obstructing neoplasm at the ampulla. We were able to put a small catheter into the common duct without releasing the pressure, and gradually to produce decompression. The fluid from the duct was at first colorless, but in six hours it became bile-stained. This patient is comfortable at present with the tube in his common duct. As he is sixty-seven years of age, there is some question as to the advisability of submitting him to operation for resection of carcinoma of the ampulla.

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THE SURGICAL TREATMENT OF CHRONIC ULCERATIVE COLITIS*

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The purpose of this paper is to call attention to a condition of serious character and by no means rare occurrence, and to a method of treatment that, while well known, seems not to have been utilized as widely as its merits warrant. Chronic ulcerative colitis is advisedly referred to as a condition rather than as a disease. Its etiology is not always clear and is not limited to a single agency. Any infection, amœbic, pyogenic, tuberculous, luetic, or from unidentified organisms, may properly come under the descriptive name of chronic ulcerative colitis, and such cases are so included in this discussion. Other terms used in the literature with practically the same meaning are chronic dysentery, and chronic suppurative colitis. It is of course desirable, if possible, to determine the type of infection. The use of the proctoscope, the microscope and bacteriologic study of bowel contents, the Wassermann reaction, general physical examination, and the history of the case are all utilized to discover the nature of the infection. By these means a certain number of cases may be clearly recognized as amœbic, luetic, or tuberculous. The therapeutic test of antiluetic treatment or emetin treatment may also be of value. But there remains a considerable group of patients who present ulceration of the large bowel, with colon and pyogenic organisms present, and no more specific causal agent to be recognized. Certain cases indeed which begin as specific inflammations, as for instance amœbic colitis, later acquire a secondary infection that so predominates as completely to obscure, if not actually to crowd out, the original infection. It is particularly this ill-defined but important group of cases, in which specific therapy is of little avail, that forms the principal object of consideration in this paper. However, any type of infection of the large bowel that is chronic and does not yield to the usual methods of treatment is equally subject to the descriptive remarks and the ideas of treatment herewith advanced.

Patients with chronic ulcerative colitis present a history of bowel trouble extending back for months and sometimes for a number of years. The onset may have been abrupt with acute dysentery or gradual and insidious. Often there are periods of improvement; sometimes of apparent cure, followed by recurrence and another cycle of improvement. The severe attacks are marked by numerous bowel movements, perhaps twenty or more a day, consisting largely of mucus, pus and blood. During these exacerbations there are loss of weight, abdominal pains, often severe, usually some fever, and marked weakness. Eating becomes very difficult to these patients, not only because of complete loss of appetite, but even more because the entrance of anything

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into the stomach starts immediate reflex peristalsis in the colon with sharp pain and urgent desire to defecate. This particular symptom, as it happens, the writer does not recall ever seeing mentioned, but it has been an outstanding and troublesome feature of nearly every severe attack of chronic ulcerative colitis seen by him. Should the severe manifestations of the condition continue long, the patient becomes gravely ill, and it is not impossible for a fatal result to ensue. Even though, because of treatment or a spontaneous recession in the infection, life itself is not lost, there is great loss of weight and strength, and a condition of marked invalidism usually persists for weeks and months.

In the intervals between these fulminating periods, improvement slowly takes place, but usually with residual symptoms that show a persisting lesion in the bowel. There is a tendency to looseness and frequency of bowel movements, usually traces of blood and mucus in the stool, and with the proctoscope it may be seen that a hyperæmia and granular appearance or even actual open ulcers are still present. Such patients, though better, are by no means well. Recurrence is very apt to take place. In fact, one of the striking clinical characteristics of chronic ulcerative colitis is its chronicity and recurrent nature.

Such is a fair picture of a condition that is fairly often met with and that means usually prolonged invalidism, involving perhaps years, and that holds a by no means remote threat of death. What is there to do for it?

The usual means of treatment are well known to all. For the specific types of infection, the specific remedies; emetin and quinine irrigations for amœbic colitis; antiluetic treatment for syphilitic ulceration; general hygienic care for the tuberculous. In addition, and particularly for the non-specific type of infections, various rectal irrigations, with solutions ranging from normal salt solution through the various antiseptics; bland and simple diet; rest in bed; opiates for tenesmus; bismuth by mouth; during acute exacerbations fluid by hypodermoclysis and morphia freely. There are still other measures that various men resort to. It is not necessary to be exhaustive. Some cases perhaps get well, many get better for a while, a few die. Those, the majority, that only get better, sooner or later get worse again. Then the treatment, or another like it, is repeated. This sequence may go on for years. Is there anything better to do, and if so, when should it be done?

In 1895, Keetley suggested making use of the appendix as a semi-permanent opening for irrigating the infected bowel from above. Weir, in 1902, is credited with first performing appendicostomy. Since then this method of treatment for infections of the colon has been followed in English and Continental clinics, as well as in this country, and a considerable literature has grown up on the subject. (Paulus,[1] Lockhart-Mummery.[2]) The results of appendicostomy, however, are not always satisfactory. It allows irrigation, but the colon is still irritated by the passage of fæces; and a wider opening of the cæcum—cæcostomy—to allow not only irrigation of the colon, but also to divert the fecal stream and put the colon at rest, was done by Boas in 1903 for chronic ulcerative colitis. This has also its advocates, Klose,[3] von Lipp-

man.[4] But a cæcostomy does not really divert entirely the contamination and irritation of the ulcerated bowel by fecal matter. To secure complete physiological rest of the colon, the logical method is to do a complete transverse ileostomy, as is well brought out by Payne,[5] who credits Dr. John Young Brown, of St. Louis, with priority in advocating this method.

What are the relative merits of these surgical methods? The writer has had some, though not extensive, experience with all of them. In general, after any of these operations, even in severely ill patients, there is immediate and rather dramatic improvement. It is not an isolated experience to note that a patient who has had fifteen to twenty painful, bloody stools daily will pass the two or three days after operation without any movement of the bowels whatever. This sudden cessation depends less on the type of operation than on the fact that following invasion of the abdomen there is a temporary paresis of peristalsis and remission of symptoms. It is in the subsequent course of events that differences may be noted between the several forms of operative treatment. Appendicostomy has the very considerable advantage that it avoids to a large extent the disagreeable features of an artificial anus. Soiling and odor are minimal or absent. *But it does not always cure the colitis,* and recurrences and constant irrigation are drawbacks of great moment to its success. The large bowel is not excluded and the treatment may fail of its primary purpose, the cure of the lesion. Cæcostomy is no more certain in exclusion of the bowel and has all the disadvantages of a fecal fistula in addition. Ileostomy is a more logical method, promises better results and in the experience of the writer, limited to a very few cases, has entirely succeeded. Such is also the experience of Payne. It has the serious drawback of an artificial anus, and women patients particularly are apt to refuse it. But the liquid normal contents of the small bowel soon change in character and much of the difficulty experienced in control of cleanliness in the early period after operation disappears. The stools become semi-solid, regular, and a certain control is developed. The writer has had three cases. Two are entirely well after two years and one year, respectively, and the third has only recently been operated on, and is still under treatment. Neither of the other methods of operating in a larger series of cases have done as well. It is the distinct impression that ileostomy is the method of choice.

In what cases should operation be employed? It is my feeling that any severe exacerbation of a chronic ulcerative colitis is in itself an indication for an operation that may save life. Further, any chronic case, even without alarming severity of symptoms, that has resisted the usual medical treatment for a number of months, should be operated on to terminate indefinite invalidism.

How long should surgical treatment be kept up, in other words, when can the artificial opening in the bowel be closed and the normal function of the large bowel be restored? The evidences of cure of the ulceration are as follows: A normal appearance of the mucosa on proctoscopic examination; the disappearance of all symptoms; the absence of pus or blood

microscopically in centrifuged salt solution that has been run through the colon from the artificial opening to the anus. When these findings are maintained two months after the stoppage of all irrigations, it is safe to close the stoma and reëstablish the continuity of the alimentary tract.

It is incidentally of interest to note how well patients tolerate complete exclusion of the colon. Both the cases now cured began to gain weight and strength at once after ileostomy, even with the entire colon thrown completely out of function.

The detailed steps of operation in all of these procedures are well known. The only comment that the writer desires to make in this matter is in regard to the method of closing the ileum used in the last case done. The steps described by Halsted [6] in his article on sterile blind end-to-end suture of the large bowel were adapted to this purpose. The ileum is divided by the cautery between two purse-string sutures, and the two blind ends are abutted against each other and a circular end-to-end suture of the bowel done by interrupted mattress sutures of fine silk. This leaves the ileum closed by a double diaphragm. The loop of ileum just above the ileocæcal valve is selected for this purpose and then the gut about two inches proximal to the closure is brought up and fastened in the wound, to be opened some hours later and have a tube placed in it. This establishes the ileostomy and the colon exclusion. The appendix is then brought up through a separate incision and used as an opening to irrigate the colon. Should the appendix not be available a cone of cæcum may be used. Later, when ready for closure, the plan is to introduce a knife downward from the ileostomy opening, perforate the double diaphragm of the Halsted closure, and then close the ileostomy.

Summary.—(1) Chronic ulcerative colitis is an obstinate, recurrent, and dangerous condition.

(2) When it resists medical treatment or becomes severe, operative attack is indicated.

(3) Ileostomy and separate appendicostomy for colon irrigations, with exclusion of the colon from function, offers best results.

CASE REPORTS

CASE I.—A. J. L., white, male, age thirty-nine, admitted July 10, 1920, to the Johns Hopkins Hospital. Past history unimportant. Present illness began three years before admission with gradual onset. Had pneumonia in November, 1917, perhaps influenzal. In January, 1918, bloody diarrhœa began, at first without much pain. Some mucus in stools. In April, 1918, amœbæ found in stools, said to be amœbæ coli. Was treated with emetin and seemed to be well for six months, but still had a little trouble, tenderness over descending colon and two or three soft stools daily. After six months, return of diarrhœa and amœbæ found again. Continued treatment by emetin and quinine injections through the rest of 1918 and 1919. In February, 1920, symptoms became worse in spite of treatment, and has had constant diarrhœa since, ten or twelve stools daily. Proctoscope showed numerous ulcers of appearance of secondary pyogenic infection. After three weeks' treatment on medical service, transferred to surgical. On August 6,

1920, a transverse ileostomy was done by Dr. W. A. Fisher, Jr. Following this the bowel was irrigated with quinine, ipecac, and neo-salvarsan in dilute solutions for a period of several weeks. There was prompt and marked improvement. Symptoms entirely disappeared. Gain in weight. Disappearance of blood and mucus from bowel washings. Proctoscope showed ulcers entirely healed. On October 19, 1920, two and a half months after the ileostomy, the fistula was closed and the alimentary tract reëstablished by ileocæcostomy. Patient was discharged November 10, 1922, having gained forty-five pounds since ileostomy. Has been followed since and has remained entirely well, with a final and sustained gain in weight of sixty odd pounds. No further symptoms of bowel trouble since operation for a period now over two years.

Case II.—D. K., white, male, age thirty-three. Past history: Appendectomy for acute appendicitis. Otherwise not important. Present illness began in autumn of 1916 while patient was serving with the National Guard troops on the Mexican border. Onset rather acute with diarrhœa, blood and mucus being passed in large quantities. Rapid loss of weight and strength. After treatment for some time in army hospitals with gradual improvement, was sent home to Baltimore on sick leave. Examination then showed typical appearance of amœbic ulceration in colon and amœbæ were found in stools. Under emetin and quinine irrigations patient improved considerably, but never was entirely well, and had periods of recurrence of more severe symptoms. These were so disturbing that in 1919 he underwent several weeks of careful and rigid medical treatment in a hospital. He was much benefited and for three or four months seemed well. However, recurrence then developed and for two more years he suffered more or less constantly varying degrees of illness. In 1921, his symptoms became severe, with twelve to fifteen bloody stools daily, marked loss of weight and great abdominal and rectal pain. He accepted the suggestion of ileostomy. Operation was done at the Union Memorial Hospital October 28, 1921, a loop of ileum about fifteen inches above the ileocæcal valve being brought into a right rectus incision, fixed there, and transversely divided the next day. The upper arm of this loop constituted a fecal fistula and the lower arm was used to irrigate the colon. Salt solution, dilute silver nitrate, ipecac, neo-salvarsan, and yeast solutions, were used in turn. The patient's symptoms began to improve abruptly after operation and he gained about twenty pounds even while the ileostomy was open and the colon out of function. On January 31, 1922, the patient had been free of blood, mucus or pus, even microscopically in colon washings for several weeks, and the ileostomy was resected and intestinal continuity established by lateral anastomosis. Since the ileostomy, now over a year, the patient has been free from any symptoms whatever, has gained permanently some thirty pounds, and has not lost any time from his occupation. Incidentally, he was able to do work for several weeks of the time between his ileostomy and the closure of it.

Case III.—Mr. L. S., white, male, age thirty-two. Past history negative except for pneumonia, 1905. Present illness began June, 1921, with diarrhœa and severe abdominal cramps. Under medical treatment there were short intervals of improvement, but prompt recurrences, severe enough to prevent patient from working steadily. In January, 1922, sent into hospital and stayed one month on medical treatment, rest in bed, and irrigations. Left hospital much better. In May, recurrence of severe type. June 9, 1922, appendicostomy. Much better, and while irrigations continued had little trouble. Discontinued irrigations in August. Appendicostomy closed spontaneously in October, 1922. Recurrence of symptoms in severe form soon after. Loss of twelve pounds in eight days. Bloody stools, fifteen to twenty daily, and great deal of abdominal pain. Transverse ileal closure by Halsted end-to-end method, ileostomy above and reopening of appendicostomy on November 13, 1922, at Church Home and Infirmary. Imme-

diate relief of pain, diarrhœa, and bleeding. No passage from colon except with salt solution irrigations.

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MESENTERIC THROMBOSIS*

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While mesenteric thrombosis, or as it might more properly be called, mesenteric vascular occlusion, cannot be classed as a surgical rarity or curiosity, it may certainly be considered one of the most serious abdominal catastrophies with which the surgeon has to deal. Some five hundred cases have been reported, and these undoubtedly represent but a small proportion of the actual number. My own personal experience is limited to four, of which the last, presenting unusual difficulties and resulting in recovery, seems worth discussing and recording.

Case Report.—The patient, a previously healthy athletic girl of twenty, was seen on August 13, 1921. Except for some indefinite digestive disturbances and a mild anæmia there was no history of past trouble. The note states that yesterday she climbed a mountain, otherwise there was no history of trauma or any unusual exertion. This morning she went shopping, came home, ate her lunch and about two o'clock was seized suddenly with violent epigastric pain. The pain continued throughout the afternoon and grew worse. It has been constant and not crampy. She has vomited frequently. She has been given soda, brandy and other household remedies, all of which she vomited.

Examination about eight o'clock at night showed a patient looking distressed and complaining of violent epigastric pain and nausea. Pulse 72, temperature 98.2. The abdomen is natural looking, respiratory movements present and everywhere free. There is no distention or fulness. On palpation there is nowhere tenderness or rigidity and no mass can be felt. An enema resulted in a good normal movement, with solid fecal material and gas, giving considerable relief. The leucocyte count at 9 P.M. was 21,000. The condition at this time suggested the possibility of a mild acute appendicitis, although the leucocyte count seemed high. At midnight the temperature was 98.2, pulse 72. There seemed no indication for immediate interference. She was therefore given ⅛ grain of morphia and all food by mouth prohibited.

August 14, 1921. She had a very comfortable night, slept some and has had no further vomiting. At eight o'clock this morning her temperature was 98.2, pulse 72. The abdomen seemed a trifle full, but there was still no rigidity and no tenderness. In the suprapubic region there was a distinct feeling as of something filling the pelvis; but there was no dullness on percussion, no tenderness and no rigidity. At ten o'clock the leucocyte count was 21,000 and her condition about the same. At noon, although the temperature was still normal, her pulse had risen to between 110 and 120. The abdominal condition was unchanged. She still had constant epigastric pain but no nausea and no vomiting. The condition suggested some grave intra-abdominal lesion, not inflammatory, and while a circulatory disturbance was considered, it was rather felt to be an ovarian cyst with twisted pedicle. The rising pulse with a suggestion of shock made further delay seem unwise and she was taken to the hospital for operation which was finally done at three P.M., about twenty-four hours after onset. The patient took her anæsthetic well and went to sleep quickly requiring very little

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ether. Her pulse was 120 when she was placed upon the table. The incision was about to be made when she suddenly stopped breathing. The pulse was imperceptible, pupils widely dilated and she was deeply cyanosed. Artificial respiration was given for several minutes before there was any voluntary breathing. Her color improved as her breathing became better; but the pulse remained exceedingly rapid and she was beginning to move on the table. On placing the ether cone over her face to resume the anæsthetic, she again stopped breathing and artificial respiration was again necessary. The pulse as nearly as could be counted at this time was 180. She was stimulated and given salt solution subcutaneously and without any further anæsthetic an incision was made from umbilicus to pubes, her movements being restrained by nurses holding the hands and feet. The ether cone was never placed over her face for the remainder of the operation, a few drops of ether being administered from time to time through a piece of gauze when her struggles became too violent, and throughout the whole operation less than a quarter of a pound of ether was used. Immediately upon opening the abdomen there escaped a great quantity of bloody fluid and there presented a large black coil of small intestine about seven centimetres in diameter, lying just above the pubes. The incision was enlarged to the left of the navel as it was evident that room would be required, and retraction was impossible because of the lack of relaxation of the abdominal muscles. The coil of intestine was delivered and was found to consist of eighteen inches of ileum, extending from the ileocæcal valve upwards. The appendix was not involved in the process and appeared normal. The mesentery corresponding to the involved coil was very thick, œdematous, and infiltrated with blood. No pulsation could be felt in the mesenteric vessels. The serosa over the coil was cracked in places, suggesting impending perforation, and the bowel was filled with fluid and gas. In spite of the bad condition of the patient it was evident that the only possible chance lay in immediate resection. There was no evidence of any twist or obstruction in the mesentery and the line of demarcation was sharply drawn at both extremities of the coil, the involved area extending exactly to the ileocæcal junction. A crushing clamp was placed across the end of the cæcum about one inch beyond the lower limit of gangrene and another on the ileum at the same distance above the upper limit and linen ligatures were rapidly tied in the crushed areas. The bowel was burned across with a cautery between the ligatures and clamps, the mesentery ligated with catgut and the whole involved coil removed. The ends of cæcum and small intestine were turned in first with a purse-string suture of linen and secondly with a similar one of chromic catgut. A lateral anastomosis was made with an outer stitch of linen and an inner one of chromic catgut. The omentum was turned down over the anastomosis and the abdomen closed. A gauze and rubber cigarette was left in the lower angle of the wound extending to the peritoneum. The patient was in an extremely poor condition at the end of the operation which, with its various interruptions, had consumed nearly two hours. Her pulse was about 180, and she was in marked shock. She reacted quickly, but was in rather serious condition for forty-eight hours. Her wound healed *per primam* and she made a rapid recovery, and was walking in three weeks. She is now, December, 1922, in excellent health and the only noticeable effect of the operation is that she has been inclined to have several movements daily, a condition which has been somewhat controlled by the administration of bismuth. A recent X-ray examination of the alimentary canal shows no abnormality and nothing to indicate any changed relations. It was thought that the frequent movements might be due to an unusually large opening between ileum and cæcum allowing the fluid contents of the ileum to pass on too rapidly. However, Doctor Christie who made the fluoroscopic examination reports that the bismuth meal progresses throughout at the ordinary rate.

This case presents several points of interest which will be taken up in the general discussion of the subject.

Mesenteric thrombosis is of particular interest because of its gravity, the difficulty of diagnosis, and the poor results of surgical treatment.

Pathologically, the occlusion may be either venous or arterial, or both vessels may be involved. Venous occlusion is less dangerous than arterial and is less frequent, occurring in about 40 per cent. of cases. It is due in most instances to a descending thrombosis, or may be in itself a primary affair due to some infectious process in the intestine, most frequently appendicitis. Arterial occlusion occurring in about 60 per cent. of cases is usually attributed to arteriosclerosis, endocarditis or to some infectious process elsewhere. This explanation will answer for those cases where the catastrophy occurs in the course of or following some infection or surgical condition. There are many instances, however, where no explanation can be given for the source of the embolus which has caused the obstruction. Such was the case under consideration; for the patient had no history of infection or trauma or any other condition which might explain the liberation of an embolus. As a matter of fact the majority of cases which come into the hands of the surgeon are of this type, and this fact possibly offers a partial excuse for the extreme infrequency of a pre-operative diagnosis. The superior mesenteric artery is occluded more frequently than the inferior, the usual explanation being that its diameter is nearly three times as great as that of the inferior; that it arises from the aorta at a higher point than the inferior, thus having an earlier opportunity of intercepting an embolus; and that its course is nearly parallel to that of the aorta, while the inferior runs off at an acute angle. The result of the occlusion is usually a hemorrhagic infarct, a pathological condition which has never been satisfactorily explained, except that while the superior mesenteric artery is not anatomically a terminal or end artery, it nevertheless is so physiologically. Ischæmic infarction is extremely rare. The amount of bowel involved depends upon the location of the occlusion. The terminal portion of the ileum is supplied by a single branch of the ileo-colic artery, an area which about corresponds to the involvement in our case. The loop of bowel supplied by the occluded vessel becomes engorged with blood, appearing greatly thickened and distended with gas and fluid. Peristalsis is decreased or entirely absent and there exists practically a paralytic ileus. Untreated, the condition goes on to gangrene and perforation, unless the area is extremely small, when circulation may be reëstablished, a condition which probably occurs much oftener than is suspected after abdominal operations. The mesentery becomes œdematous and infiltrated with blood to such an extent as to interfere with motility of the intestine. This was most striking in the case under discussion, the mesentery being two or three centimetres in thickness.

The early symptoms of mesenteric thrombosis are practically those of any intra-abdominal catastrophy. They vary according to whether the case is a primary fulminating one or of the secondary type appearing as a compli-

cation of preëxisting disease. Pain of sudden onset, severe and agonizing, is the most striking and the earliest symptom. Its location varies according to the point of occlusion or it may be generalized throughout the abdomen. It is most often about the navel or in the epigastrium. It has been explained as being due to dragging on the mesentery from excessive peristalsis caused by obstruction in the affected loop. In our case through long periods of observation no peristalsis could be made out, even by careful auscultation with the stethescope over the abdomen. It seems to me that a better explanation is that it is due to distention and œdema of the mesentery which we know to be so highly sensitive. In our case the pain was also constant, which would not be the case were it caused by peristalsis. It may be compared to the steady pain of an appendicitis due to infiltration of the appendicular mesentery. There is often tenderness and abdominal distention, both of which were entirely lacking in our case, but rigidity and muscle spasm are not seen except in the very late stages when there is peritonitis from perforation or passage of organisms through a gangrenous bowel. As the condition progresses the coil of intestine becomes more and more distended with fluid and gas, and may be felt as a tumor, and there may be dullness in the flanks from free fluid in the peritoneal cavity. A more constant finding is a feeling of resistance to palpation, as in the present instance, which does not amount to the sensation given by an actual tumor. Vomiting is a marked disturbance simulating the picture of intestinal obstruction. It tends to decrease after the first few hours, thus suggesting that it is reflex rather than due to a complete obstruction. The vomitus may contain blood, but rarely becomes fecal. There is usually complete absence of voluntary bowel movements from the onset, and it is difficult to obtain a satisfactory movement, although complete obstruction is most unusual. In rare cases there is diarrhœa with bloody stools. In the present instance there was frequent and severe vomiting without any blood during the early hours. This ceased entirely following an enema given seven hours after onset. There was no diarrhœa and an enema resulted in a normal movement without blood. There is no rise of temperature except in the late stages. The pulse is striking and sooner or later leads one, as in the present instance, to suspect some grave intra-abdominal vascular disturbance. The pulse becomes rapid and small as the condition is well established. With the pallor and often cyanosis of the skin, normal or subnormal temperature, there is presented a well-marked picture of shock. It is said that there is a rapid drop in hæmoglobin due to the loss of blood into the infarcted area. Little has been said of leucocytosis which in our case was 21,000, although this count is not unusual with any type of intestinal obstruction.

The extreme variations in the symptoms and clinical picture account for the frequent failure in diagnosis. In the present instance the possibility of ovarian cyst with twisted pedicle was considered and, I must confess, that mesenteric thrombosis did not occur to me. Intussusception, volvulus or some other form of mechanical obstruction is difficult to differentiate, as is

also acute pancreatitis; and the conclusion reached by the surgeon is that there is some lesion associated with the intra-abdominal vascular system which demands operative interference. Loop emphasizes the point that it is a mechanical, as contrasted with an infective process, a fact which should be an aid to diagnosis in the early stages. Occasionally the diagnosis is made before operation.

In the four cases which I have personally encountered, the first was operated upon for abdominal symptoms in the course of typhoid fever, an intestinal perforation being suspected. The symptoms proved to be due to a very extensive ascending thrombosis which involved the mesenteric vessels. Practically the whole intestine was involved and death rapidly resulted. The second case, a male, aged forty-one, was seen at the Johns Hopkins Hospital in July, 1900, having been suffering severely for four days with agonizing pain just to the left of the umbilicus. He had had frequent vomiting and no passage of the bowels for two days before admission. His temperature was 102°, pulse 140, respiration 31; skin cold and clammy; lips and mucous membranes pale, abdomen distended uniformly and tender on pressure especially on the right side. There was dullness over the right lower abdomen extending nearly to the median line; no visible peristalsis. The general aspect of the man strongly suggested a severe intra-abdominal hemorrhage. A diagnosis of mesenteric thrombosis was made and immediate operation advised. The peritoneal cavity contained a large quantity of bloody fluid, and a large distended blue-black coil of small intestine was found filling the right side of the abdomen. The mesenteric arteries were thrombosed. Intestine amounting to 275 cm. was excised, the ends being brought out on the abdominal wall. An anastomosis was not done because of the extremely grave condition of the patient. He died seven hours after the operation. No autopsy was permitted and the exact location of the coil of small intestine was not determined. As I remember it, the diagnosis was made because of the history of obstructive symptoms, the general shocked appearance of the patient, and the dullness in the right side of the abdomen, his whole condition giving the impression of a grave intra-abdominal vascular lesion. The third case, seen in the last year, was a man aged fifty who was brought into the Emergency Hospital in a moribund condition with a history of three days illness, characterized by sudden onset of intense abdominal pain with continuous vomiting and subnormal temperature. He was in extreme shock, cyanosed, cold and clammy. He presented much the same picture as the second one and mesenteric thrombisis was suggested as a possible diagnosis. He failed to react to heat and stimulation and died in an hour or two, no operation being attempted. Autopsy showed mesenteric arterial thrombosis with involvement of several feet of lower small intestine. Thus in our four cases the diagnosis of mesenteric thrombosis was properly guessed in one and suspected in a second. Finney reports an interesting case in a patient who had suffered for years with Reynaud's disease and had been in the hospital many times for treatment. She suddenly developed abdominal symptoms in the course of a severe attack and came into the hospital with a diagnosis of acute intestinal obstruction. Finney made a diagnosis rather jokingly of mesenteric thrombosis, operated, and found three feet of ileum just above the ileocæcal valve involved. He did a resection and she made a good recovery.

In regard to treatment, it is naturally surgical. Operation at the earliest possible moment with immediate resection of the affected area with a safe margin of healthy bowel offers the best chance of recovery. The results,

however, are disappointing from a statistical point of view, the mortality in operated cases being variously estimated from 75 to 90 per cent. Klein, in an excellent article last year, stated that about twenty-four successful resections had been reported since Elliott's first case in 1895. Undoubtedly they are not so uncommon, for in the discussion of Mason's paper before this Society last year three successful cases were added to his, and McGuire has recently reported two more brilliant results. In a paper by Ross it is stated that in the records of the Lankenau Hospital in Philadelphia during a period of ten years, in 30,000 surgical cases there were only two of mesenteric thrombosis. He reports five cases of which one recovered after operation. In this patient operated upon by Deaver there was found a thrombosis involving a segment of ileum, the amount not noted. The bowel was in fair condition and the abdomen was closed without resection. In the discussion of this paper Peck reported two cases of probable mesenteric thrombosis. In the first case the amount of intestine involved was so extensive that resection was not considered. He did a cæcostomy for the purpose of irrigating and the patient recovered. In the second case where the question of thrombosis was uncertain, but the intestine dark and swollen without discoverable cause, it was simply returned and the abdomen closed with subsequent recovery. These cases would seem to show that in some instances the involved bowel may be taken care of by collateral circulation, or that there may possibly be an incomplete obstruction of the vessels, so that the bowel is capable of restoration of circulation and function. It is probable that many post-operative abdominal disturbances may in reality be due to temporary or incomplete occlusion or to the blocking of a small branch of the mesenteric the function of which is quickly assumed by collateral circulation. Klein reports in detail nine cases in which there was a probable diagnosis of mesenteric occlusion, all of which recovered spontaneously. This, nevertheless, does not affect the rule that with acute symptoms and a suspected diagnosis of occlusion of the mesenteric vessels, the only rational procedure is abdominal exploration.

A feature of the sequelæ in the case herewith reported has been the frequent bowel movements, which might be explained by the free anastomosis between small intestine and cæcum with the elimination of the ileocæcal valve. The removal of eighteen inches of small intestine would not seem to be sufficient to have an etiological influence and there has been no disturbance of nutrition.

As it is sometimes necessary to remove a large section of intestine in order to make an anastomosis in healthy tissue, it is interesting to consider just how much can be taken away with a chance of recovery and what may be expected later in the way of interference with metabolism and nutrition. This subject has been carefully studied by Flint who collected from the literature fifty-eight cases in which more than 200 cm. of small intestine had been removed. Of these, forty-nine survived the operation. The greatest amount resected was 540 cm. in a case of strangulated hernia reported by Brenner.

This patient apparently recovered with little disturbance of nutrition, but died two and a half years later of inanition.

The clinical manifestation of the metabolic disturbance consists largely of a diarrhœa, usually slight, with two or three soft or fluid movements a day. The stools show inability to absorb fat. In other cases the diarrhœa is of a fulminating character and may contribute actively to a fatal outcome. Another type of reaction is shown when the patients recover temporarily, but suffer from such profound limitation of the power of absorption that they die later, as in Brenner's case. Experiments on animals show that there is a compensatory hypertrophy, as well as hyperplasia of the remaining portion of the small intestine. Flint concludes that in humans as in animals about 50 per cent. of the small intestine may be removed without much danger of serious consequences in the majority of cases. The resection of smaller amounts may, however, be followed by severe metabolic disturbances, and even inanition and death. The matabolic disturbances bear no definite relationship to the amount of small intestine resected. Resections of over 400 cm. have recovered while death from inanition has resulted from the removal of 284 cm. and profound digestive disturbances from the resection of 192 cm. of ileum. The surgical rule then is to resect always as little of the intestine as the pathological condition will allow. The metabolism of patients who have undergone extensive resection should be aided by a rich and easily assimilated diet, poor in fats and relatively rich in carbohydrates.

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SARCOMA OR EMBRYOMA OF THE KIDNEY IN INFANTS*

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The type of tumor referred to in this paper is that of the rapidly growing tumor of the kidney found in infants and very young children and evidently of embryonic origin. These tumors have always been of interest and have been the subject of considerable study and investigation. Clinically they have commonly been referred to as sarcoma of the kidney in infants, but histologically they have been described by a number of names, depending on the histological elements found. The first attempt to separate these embryonal tumors into a class by themselves and differentiating them from other kinds of growths, was made by Birch-Hirshfeld in 1894, and since then they have been studied and reported by various observers who have also advanced theories as to their origin. An unanimous opinion on this point has apparently not yet been reached. They are, however, always embryonal in origin and are the result of inclusion.

The confusion in the nomenclature has been due not only to the variety of tissues found but to the findings of both epithelial and mesoblastic elements. The most interesting structures are the rudimentary tubules and glomeruli. The tubules are often quite definitely formed and show a lumen lined with cuboidal cells and with a basement membrane. The most frequent tissue found and most predominating is the proliferating connective tissue which usually forms the stroma of the tumor and in which the other structures are situated. In addition to these characteristic constituents there may be found striped and smooth muscle fibre, cartilage, fat, bone, collections of epithelium, and a rudimentary substance from the nervous system. However, all of these tumors, whatever may be the predominating tissue, are evidently of the same origin, present the same history and characteristics and contain both epithelial and mesoblastic elements. They are therefore referred to as mixed tumors. In those cases where one element only is reported, the examination is doubtless incomplete. These tumors are usually rapid in growth and reach a very large size, often completely filling the abdomen of the infant before they are brought to the surgeon. They are usually smooth and globular in shape and the average size at the time of removal is that of a grape fruit. They usually occur in the substance of the kidney and the growth is expansive, displacing the normal kidney structure but not infiltrating it. The kidney tissue that is pressed upon atrophies, but the balance of the kidney retains its normal shape, appearance and function, and usually presents itself as a nubbin projecting from the periphery of the tumor. The tumor apparently presents a very definite capsule which, however, is adventitious. Metastases are relatively infrequent and the lymphatics are almost never involved. Notwithstanding this these tumors have

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been found to be intensely malignant with a high rate of primary mortality from operation and a high rate of recurrence, so that a total mortality rate including that of operation and recurrence has been reported as high as ninety-three plus per cent.

Recently, Loughnane, quoted by Mixter, reports, of thirteen personal nephrectomies, there was one death from operation only and the late results were: Results unknown, three cases; survived three years or more, four cases; alive and healthy two and one-half years after operation, two cases; died from intercurrence of phthisis within three months, one case. This is the most favorable

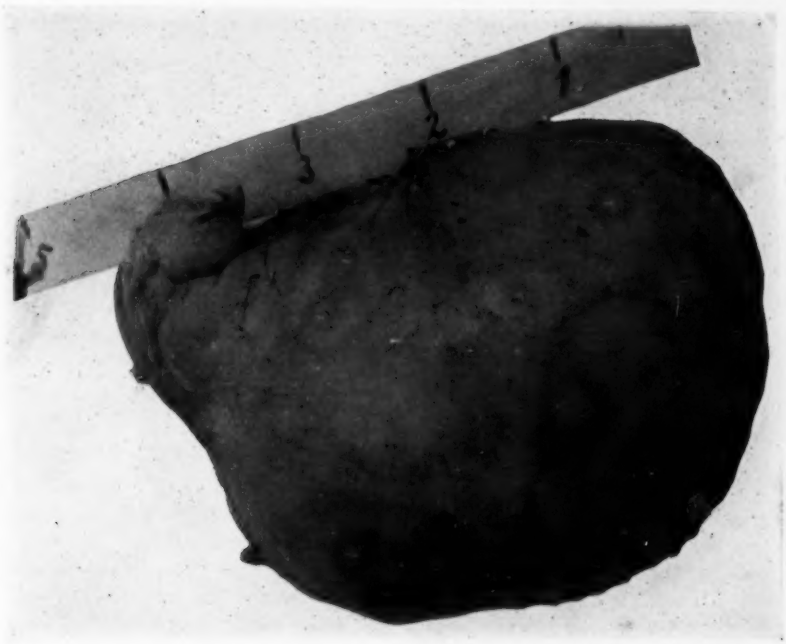

FIG. 1.—General appearance of tumor growing in lower pole of kidney with a perfectly normal upper pole.

group of results that I have been able to collect, and is I think unusual. It may be that the cases were detected and operated at a very early period or the cases may have been selected for operation. However, other reporters who have had cases to survive have found that this has taken place in advanced cases also. In the cases reported by Mixter there was an operative mortality of thirty-five per cent. in fourteen nephrectomies and nine survivals, and of these all showed rapid recurrence and death except one who was alive and well three and one-half years following nephrectomy. The symptomatology is quite different from that of malignant disease of the kidney in adult life. Hemorrhage is quite infrequent and urinary findings are negligible. This is quite easily understood when the tumor is examined. It is a tumor in the kidney and not of the kidney and that portion of the kidney which is not affected by pressure is perfectly normal. The patient is usually somewhat anæmic looking, usually suffers to

some extent from digestive disturbance but there are no characteristic or pathognomonic symptoms, and the diagnosis of the case is involved in finding the tumor. This is usually quite accidentally discovered by the parent. The tendency for children to have enlarged abdomen in various conditions as a rule prevents the parent from suspecting a serious condition, and the absence of symptomatology does not suggest the calling in of a physician until the disease is well advanced. The majority of these cases undoubtedly are discovered in children's hospitals where routine examinations are made of all cases. As to the outlook in this condition, it would appear that better results may be secured. If the family physician and pediatrician are on the outlook for them they will doubtless be discovered when the tumor is still small and before the general health of the patient has been affected.

Radiation has accomplished so much in other conditions that it should be of great value in this. The complete removal of the tumor in favorable cases with subsequent radiation should give better ultimate results. The diagnosis depends on finding the tumor, which is usually of firm consistency, globular and of regular outline, with a certain amount of mobility in operable cases and which can be traced to the kidney region. Should doubt exist as to the nature of the tumor, ureteral catheterization and a pyelogram will be of great value.

My own experience is limited to four cases, only one of which will be reported. This case is of interest because the specimen gives a very typical example of the tumor and because the patient is still alive and in robust health after the operation.

Case Report:—Number 26–7. R. M. F., twelve months of age. Male. Patient referred on January 4, 1921, on account of a lump in the right side of his abdomen. His mother stated that his abdomen had always looked full but she had not noticed any lump in it until three days ago when it was noticed when the baby was on its father's lap. The baby does not seem to suffer any discomfort, has always been hearty and bowels normal, but has looked rather delicate. He had been suffering from a suppurating middle ear, but his mother said that he appeared to be picking up some and she had not noticed any loss of weight. She had not noticed anything abnormal about his urine.

On examination the patient was found to be rather pale looking with prominent veins. The abdomen was distended and in the right side of the abdomen a globular tumor was found nearly filling the entire abdomen. It could be palpated posteriorly in the right kidney space and flank and seemed to be somewhat attached at this point although freely movable. The pelvis and subcostal region appeared to be clear and the tumor projected anteriorly. A diagnosis of sarcoma of the kidney was made and operation advised which was done two days later.

The incision was made in the semilunar line and on opening the abdomen the ascending colon and small intestine were found displaced to the left by the growth of the tumor. The peritoneum was incised external to the ascending colon and the kidney removed from its bed without difficulty. The pedicle was isolated and the vessels and ureter ligated separately. At the lower pole of the kidney an aberrant artery and vein were found to enter. These were ligated separately. There was comparatively little bleeding and this was easily controlled, the peritoneum was sutured and the abdominal wound closed without drainage.

The tumor was about the size of grape fruit and sprang from the lower pole of the kidney, the upper portion of the kidney being quite normal. A number of vessels radiated from the hilum to the periphery of the tumor. The patient stood the operation very well and was only slightly shocked. Following the operation his temperature went up gradually until it reached 102, where it remained until the eighth day following the operation when it dropped suddenly. In the meantime he had developed a discharge in his left ear, which had previously been infected. This apparently accounted for the temperature. He was discharged from the hospital two weeks after the operation, apparently in excellent condition, and three months later his mother wrote that "the baby is doing lovely. He had some trouble with his ear for a while but made a complete recovery. He sleeps fine, is real fat and crawls any and everywhere." In October of this year she wrote me that he had a double pneumonia in the spring and had been very ill but had

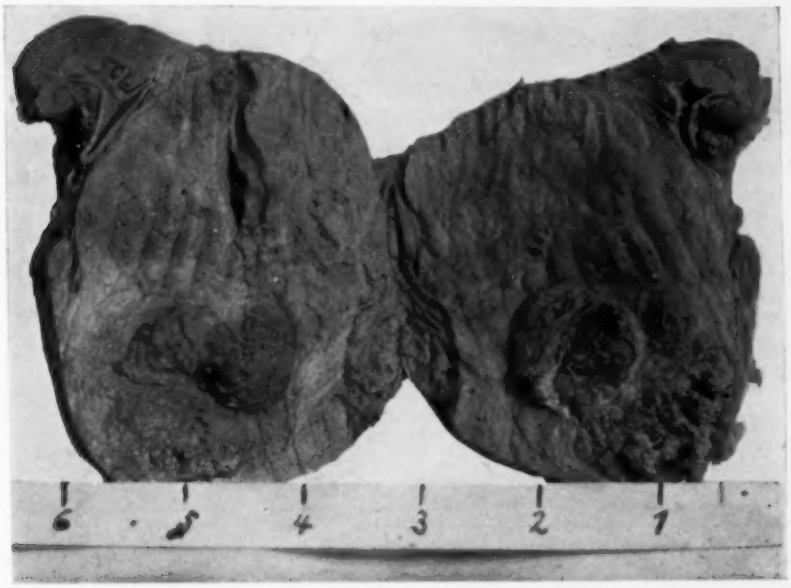

FIG. 2.—Specimen split open. Upper pole and pelvis normal. Apparent capsule made of displaced and thinned kidney substance and kidney capsule.

recovered from that. A week later she brought him to my office where I made an examination and found him in excellent health, his wound nicely healed and no evidence of any tumor or swelling.

The following is the report on the tumor, made by Dr. Ward H. Cook, Professor of Pathology in the Medical College of Virginia:

"S–22–546.—Specimen received in Kaiserling's fluid No. 1 in which it has been preserved since January 6, 1921.

The specimen consists of an ovoid tumor 11 x 8 x 7.5 cm. which occupies the lower pole of a small lobulated (infantile) kidney (Fig. 1). Excepting perhaps in the thinned lower tip of the organ, the tumor is definitely encapsulated by fibrous tissue which is continuous with the capsule of the kidney. The tumor tissue is softer than the kidney substance, is faintly lobular but otherwise homogeneous in the upper portion, marked by a wedge-shaped fibrous septum mesially, soft and friable laterally, and contains large rounded masses of soft thready consistence in lower third. (Fig. 2.)

Microscopic.—Sections are examined from every portion distinctive in gross appearance. These show a lobular tumor, the lobules of which vary greatly in size and form. The larger lobules consist of short, closely set, spindle-shaped cells indistinctly separated into small groups by vascular spaces of capillary structure and delicate, twisting strands of fibrous tissue. Occasionally within such groups there is perfect epithelial differentiation in the form of tubules of single-layered cuboidal cells and glomerular structures composed of vascularized plugs of fibrous tissue, somewhat lobulated, covered by low cuboidal cells and projecting into a dilated tubular structure. Other cell groups show epithelial differentiation less perfect, both as regards convoluted tubules and glomeruli, yet definitely indicated.

Other lobules consisting of small rounded cells with relatively large deeply staining nuclei show a similar tendency. Some of the cells, having developed more cytoplasm, are to be seen in rosettes which occasionally are found with a definite lumen, thus assuming an acinar structure. The epithelium-like cells which make up such acini are sometimes in two or even three rows. Still other areas of the tumor exhibit small, more widely separated lobules, each of which contains what appears to be a rudimentary structural unit of the renal cortex. The formation of glomeruli is a striking feature. Mitotic figures are of frequent occurrence throughout the tumor. Careful search fails to reveal either smooth or striated muscle fibres.

The tumor is evidently derived from a portion of the anlage of the metanephros which has retained its embryonic character and growth activity. It is producing epithelial and connective tissue elements and probably also endothelial structures. Diagnosis: Mixed tumor of the kidney."

SPONTANEOUS HÆMATOMA IN SARCOMA OF KIDNEY*

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Many cases of rupture of organs without an external or penetrating wound have been reported. The liver, spleen, kidney, stomach and intestines have been ruptured in this manner. Of all organs exposed to such an injury the kidney appears to be the most susceptible. Küster,[1] Herzog[2] and others have recorded several cases; the writer has reported three.[3] Küster[4] believes that such rupture is due to hydraulic pressure within the kidney. Other writers attribute the injury to pressure of the distended kidney against the transverse processes of the vertebræ, or to the pressure of the ribs or the diaphragm or other muscles. Severe muscle strains from pulling, jumping, lifting an heavy object or a sudden twist of the body have been mentioned as causes.

If such factors as these may rupture a normal kidney, it is not remarkable that a diseased kidney might burst from less force or from no apparent extra-renal force at all. A few cases of spontaneous rupture of pathological kidneys are to be found in the literature. It is not believed that a perfectly normal kidney could rupture spontaneously. Wunderlich[5] described the condition in 1856 and called it spontaneous apoplexy into the capsule of the kidney. Lippens,[6] in 1913, collected twenty-three cases, two of which were bilateral, and Wade,[7] in 1915, stated that thirty cases had been reported.

The common underlying pathological cause has been acute or chronic nephritis. The case described by Thomas[8] occurred in an hydronephrotic kidney filled with stones. In some instances an hæmatoma has formed under the capsule of the kidney, but usually the capsule ruptures and blood escapes into the perirenal fat, producing a large hæmatoma.

The present case is spoken of as spontaneous hæmatoma instead of spontaneous rupture because the hæmatoma, on account of its enormous size, was the outstanding picture rather than the comparatively small rupture. The case is unique for two reasons: First, because the writer has been unable to discover in the literature the report of a similar condition occurring in a neoplasm of the kidney; and second, because the rupture of the kidney and formation of the hæmatoma were the first signs of the disease manifested in the case. Previous to this time the patient had been in good health, and presented no symptoms which would lead one to suspect her of having anything wrong with the kidney. Apparently the rupture occurred early in the course of the disease.

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Case Report.—The patient was white, female, fifty-one years old. Two children, the youngest seventeen. Her past history negative, except several years ago she had a vaginal hysterectomy for prolapsus with satisfactory results. At ten A.M., August 23, 1922, while walking, she was seized with a sudden violent pain in the left loin, accompanied by extreme weakness, faintness and nausea. She was taken home and seen by her physician within two hours of the onset of the condition. He found her in a state of collapse, with a very weak pulse, a distended abdomen, and an easily discernible mass in the left loin. She was then vomiting and on account of this symptom, and the distention, his first thought was of intestinal obstruction. High enemata, after several trials, gave a large evacuation of fæces and gas, and the general condition of the patient improved. Six or eight hours later she relapsed into her previous critical condition, and the mass in the loin had reached its maximum size. The pain was still very severe, and morphia was given. The abdominal distention recurred, and was relieved with difficulty.

It was not known whether the patient voided urine while expelling the enemata, but twelve hours following the beginning of the attack eight ounces of urine were obtained by catheter. This specimen was perfectly clear, acid, with a specific gravity of 1026, no albumen, sugar, pus, nor blood, and no other abnormal elements except a few hyaline casts.

The patient was first seen by the writer thirty hours after she was taken sick. She was then markedly distended, and a high colonic irrigation brought away much gas and the dark fluid from previous injections. She had passed about twenty ounces of urine since the trouble first began, and the examination of a second specimen was also negative for abnormal constituents. She drank some water and had perspired profusely. Any movement of her body brought on nausea. Her pulse was 90, regular and weak; respiration 20 and shallow; temperature 99½. Blood count showed 8000 leucocytes. Heart and lungs negative. No swelling of the extremities. Pelvic examination threw no light on the condition.

The mass in the left loin was the size of one's head and extended toward the pelvis. It was tender, hard and immovable. Gentle inflation of the descending colon with air showed that the mass was retroperitoneal; it could not be the spleen, therefore it must be the kidney or about the kidney. The case gave one the impression of a hydronephrosis, due to the sudden kinking of the ureter or blockage by a stone. There was no X-ray equipment available, and the weakness of the patient and difficulty of moving her seemed to contra-indicate the use of the cystoscope. A kidney functional test was not performed. The acuteness and severity of the condition, without any previous history as a guide, called for an exploratory operation.

Under ether anæsthesia a posterior oblique incision was made over the left kidney. The mass proved to be the kidney, its lower pole enveloped by an hæmatoma 22 cm. in diameter, apparently held within the perirenal fat. The whole was easily loosened and delivered, with but very little bleeding. Hemorrhage from the kidney seemed to have stopped. It was observed that a new growth, 7 cm. in diameter, probably malignant, occupied the lower third of the organ. The remaining two-thirds, though normal in color and consistency, seemed to be shrunken, and the renal vessels and ureter smaller than usual. From this it was inferred that the kidney was performing but little function. A nephrectomy was done since the patient's previous good health warranted the belief that the other kidney was excreting normally.

Examination of the excised organ showed that it had "blown out" at its lower pole through the new growth, producing hemorrhage and the enormous

hæmatoma. What excited the rupture at this particular time could not be determined. It could not be proved that a large vessel had become invaded by the growth. The pathological diagnosis of Dr. John Funke was spindle-cell sarcoma. On account of the fatty tissue found in the growth he thought it might have started as a lipoma.

The patient passed eight ounces of urine twelve hours after the operation, and the amount gradually reached normal. The urinalysis report a short time ago was negative, and recent skiagrams have failed to show any metastases. She has received several exposures to deep X-ray therapy, and her condition to-day seems excellent. In the presence of malignant neoplasm, rupture of the kidney was considered a fortunate circumstance since it called attention to a condition which otherwise would not have been recognized until it was much further advanced.

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URETERAL INJURIES DURING PELVIC OPERATIONS*

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Accidental injury may occur to one or both ureters and may be inflicted with ligature, clamp or scissors.

Ligation.—Events developing subsequent to ligation depend upon whether one or both ureters are ligated and the length of time elapsing before remedial measures are instituted. Unilateral ligation done accidentally, provided the other kidney is sound, usually passes unnoticed. The other kidney silently takes upon itself the function of both or, at most, there is no more evidence clinically than tachycardia with pain and tenderness over the loin of the affected side (Robinson),[1] Judd,[2] Frankenstein,[3] and others have taken advantage of this fact to deliberately ligate and drop one ureter in operating upon cancer of the bladder involving one ureteral orifice when it was found inexpedient to implant the resected ureter into the bladder. In rare instances anuria has resulted from reflex suppression after ligation of one ureter, as in a case mentioned by Robinson [1] in which decapsulation of the sound kidney restored function. If infection already exists it will nearly always be necessary to remove the kidney.

The results of ligation are manifest in the kidney, the ureter above the seat of ligature, and in the ureter at the point of application of the ligature. Animal experimentation has shown that dilatation of the ureter and pelvis of the kidney begins at once after ligation, with progressive impairment of kidney function until at the end of four or five weeks the kidney is functionless. Up to a certain point in the progressive damage which is taking place in the kidney, release of back pressure by nephrostomy or deligation may result in restoration of function to normal. The time within which restoration to normal may occur is set by Johnson,[4] from animal experiments, at two weeks from the time of ligation.

It is probable that this is at least approximately true in man, for in a case reported by Caulk and Fischer,[5] in which both ureters were ligated, double nephrostomy on the eighth day was followed by complete restoration of function, and there are other cases reported of return to normal function after a shorter period of occlusion.

The damage done locally by the ligature may vary in degree from slight trauma, quickly repaired, to complete occlusion by cicatricial formation at the point of injury. The amount of damage seems to be directly proportionate to the length of time the ligature remains in place. In animal experimentation, where the ureter is isolated and tied, greater damage results than after accidental ligation during operations where more or less of surrounding tissues are included in the ligature. This is proven clinically by many reported cases

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in which prompt loosening of the ligature has resulted in immediate and permanent restoration of ureteral function.

Kolb [6] removed a ligature, accidentally applied, after twenty-four hours and at autopsy shortly after there was no evidence of necrosis at the point of ligature. Kroemer [7] reports two cases in which immediate loosening of the ligatures gave permanent relief.

Even complete cicatricial occlusion may not be permanent. In the article by Caulk and Fischer, above alluded to, the process of canalization after cicatricial occlusion following ligation in animals is beautifully illustrated, showing complete repair in six weeks; and in their case in which double nephrostomy was done on the eighth day after bilateral ligation, repair of the ureters was complete, with passage of urine by the bladder, on the fifty-eighth day.

Clamping.—Judging from what may be found in the literature, injury from clamping is a rather rare incident but, as one would suppose, results in greater damage over a larger area.

The injury resulting is either a necrosis with fistula formation or a more or less complete stricture, depending upon how long the clamps remain on.

Furness [8] mentions a case in which clamps were accidentally applied to both ureters, and though they remained on only seven or eight minutes both ureters sloughed, fistulæ forming on the eighth and twentieth days.

In a personal experience the left ureter was accidentally clamped but immediately released. Had I then been aware of the result in Furness' case I would at least have considered the advisability of doing a resection with anastomosis. Nothing was done, however, and the patient made a good clinical recovery though it is possible and even probable that stricture formation resulted.

Severance.—Injury by the scissors means either a simple severance of the organ or the removal of a segment. Fortunately this injury is usually detected at once. Either there is an escape of urine which tells the tale or the severance of a tubular stricture of such size arouses suspicion which leads to an examination and detection of the injury. If not detected there results the usual signs and symptoms of urinary infiltration.

Case Report.—On November 3, 1921, E. R., a colored woman, was admitted to the Memphis General Hospital. Married five years, no pregnancies. Menstruation normal. Urine showed an occasional pus cell and an occasional granular cast, no albumin. Blood count normal. Wassermann negative. Physical examination was negative except for the presence of a smooth, solid tumor filling the lower abdomen and reaching within two inches of the ensiform. Pelvic examination showed the cervix high up posteriorly and the tumor almost filling the pelvis. Diagnosis; myofibroma.

Operation November 8, 1921. Realizing that the tumor in its growth had probably brought the bladder above its normal position, the abdomen was entered just below the umbilicus and the wound enlarged both upward and downward. On delivering the tumor, the bladder was at once seen to be spread out on its anterior surface, reaching upward to the umbilicus and well out on both sides.

Its walls were quite thin and so adherent to the fibroid that on stripping it down a rent two and a half inches long was torn in its summit. The uterus and broad ligaments were low in the pelvis and could not be reached until the last steps in the removal, but by rotating the tumor backward the cervix could be reached and the tumor removed from below upward.

Being fully aware of the fact that the ureters must lie in an abnormal position, every care was taken to prevent injury to them and only blunt dissection was employed until it was thought that they must be safe. Nevertheless, they were both cut in the last stages of the operation but at such a point that implanation into the bladder could be made without tension. Two lateral flaps were made at the end of each ureter by longitudinal incision three-eighths of an inch long dividing the anterior and posterior walls. After drawing the ureters through an oblique puncture in the bladder wall these flaps were bent outward and stitched to the mucosa with a single fine catgut suture. A single fine silk suture on the outside, going through muscularis and periureteral structures, served to fasten the bladder snugly around the ureter and prevent its being pulled out. The tear in the bladder made the implantation particularly easy. The bladder wound was closed and the operation completed in the usual manner. A urethral catheter was kept in the bladder for ten days.

Her convalescence was unusually smooth. The urine, which at first was bloody, soon cleared up and a cystoscopic examination before she left the hospital showed urine discharging from both ureters. No attempt was made to catheterize the ureters at that time but she was passing about forty-five ounces a day, sp. gr. 1016, acid and normal except for a faint trace of albumen and an occasional pus cell.

Three months later another cystoscopic examination was made by Doctor Cullings and the following report returned:—"Cystoscope introduced into bladder without difficulty. Bladder mucosa apparently normal except for several small areas at the base showing slight congestion, and a few small bits of pus membrane adherent to these areas. Natural ureteral openings normal in appearance except for a rather 'ironed-out' appearance. Catheter introduced into both right and left and passed up each about one inch. Both openings still show intermittent contractions.

"Artificial ureteral openings appear above on the post-bladder wall about one and one-half inches from original opening and are separated by a distance of about two inches. Each is marked by a small pedunculated body about the size of a B.B. shot. Right opening is situated just above the pedunculated body marking its location and is quite large. Left opening is located on the lower surface of the pedunculated body of that side and is very small, in fact so small that close inspection is necessary to identify it. There is an intermittent pulling in of both ureteral openings not unlike that of the normal, but no swirl of urine can be detected from either. Catheter passed up to right pelvis with ease. Urine discharged at normal rate at first but soon slowed down to an occasional drop. At first, discharge was intermittent as in the normal. Catheter could only be passed into the left ureter to a distance of one-half inch, where obstruction was met. Very small catheters and also very stiff ones were used in an effort to get by the obstruction but at no time could any of them be passed far enough to include the catheter eye. Phenolsulphonephthalein, 1 c.c. injected intravenously appeared in the urine of the right kidney in twenty-three minutes. I feel rather sure that this is not entirely accurate as the discharge of urine through the catheter was not normal at that time, having slowed down considerably. The phthalein output in two hours was 54 per cent."

After injecting the right pelvis with 25 per cent. sodium bromide solution a pyelogram was made by Doctor Conly who reported that "The pelvis appears large, but in relation to the size of the calyces it is regarded as normal. The ureter does not appear at all dilated."

Blood examination showed urea nitrogen to be 35.28 and creatinin 2.36 mg. per 100 c.c.

Although during the operation every effort was made to prevent traumatic injury to the structures and the immediate result was perfect as shown by the cystoscopic examination two weeks after operation, the final result was a complete blocking of the left ureter, probably from cicatricial contraction one-half inch above the anastomosis, and impaired function of the remaining kidney as shown by the moderate retention of urea nitrogen and creatinin in the blood though the elimination of phthalein was normal.

Treatment.—The knowledge of accidental injury by ligation implies that both ureters have been tied. This, of course, means that the condition must be remedied or the death of the patient will result. The remedial measures which may be employed are five: (1) Removal of the ligatures. (2) Implantation of at least one ureter into the bladder. (3) Uretero-ureteral anastomosis on one or both sides. (4) Nephrostomy. (5) Severing one or both ureters and bringing the proximal ends to the skin surface.

In considering what remedial measures to employ, it must be kept in mind that the patient, in the near past, has already been subjected to a major operation and usually a serious one, because it is in the bad cases that the accident occurs. Removal of the ligatures is the procedure of choice and when done early there is good reason to expect a satisfactory result. It is more easily accomplished when undertaken before the organization of wound exudates has obscured the field. If for any reason there is delay, the least that one may expect is more or less complete stricture formation with incidental damage to the kidney, and simple deligation will not suffice. In order of choice, ureterovesical implantation, uretero-ureteral anastomosis or nephrostomy may be employed. In the event of the patient's condition precluding the possibility of choice, the least time consuming procedure must be followed and this is nephrostomy. Double nephrostomy may be done in a few minutes with the expectation that absorption of the ligature and canalization will result in due course of time while the condition of the patient may make an anastomosis a formidable procedure. If canalization is not satisfactorily accomplished the patient is in good condition for anastomosis or implantation. Severing the ureter and bringing the proximal end to the surface has been employed, but one can hardly imagine conditions under which one of the other methods would not serve a better purpose.

Injury from clamping, when it is necessary to do anything, means that the injured area must be resected and the problem of repair is then the same as when the ureter is accidentally severed. Whether simple ligation above and below the seat of injury, uretero-ureteral anastomosis or a vesical implantation shall be done, will depend upon the choice of the operator, the location of

the injury and the condition of the patient. Peterson [9] recommends the invagination and the end in side methods as giving the best results of the various methods of anastomosis.

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TYPHOIDAL OSTEOMYELITIS*

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Notwithstanding 0.82 per cent. of all typhoid cases develop metastatic bone disease and 0.45 per cent. of all osteomyelitic lesions are typhoidal (Murphy), but scant consideration has been given the subject by American writers. As long ago as 1835, Maisonneuve [1] recognized osteomyelitis as a complication of typhoid. In 1876, Keen [2] from an analysis of thirty-seven cases decided that a definite connection existed between the attack of typhoid and the subsequent bone affection, but it remained for Ebermaier,[3] in 1889, to isolate in pure culture the typhoid bacillus and thereby establish definitely the dependence of the bone manifestations upon the initial disease. Whilst the bone distempers consecutive to typhoid fever are most commonly due to the typhoid bacillus, the abscess may be the seat of a mixed infection, or it may contain the pus cocci or it may be sterile. Of the fifty-one cases of inflammatory bone disease presumably of typhoidal origin collected by Keen in a second paper [4] published in 1898, thirteen grew the ordinary pyogenic cocci and thirty-eight the typhoid bacillus alone or in combination with other bacteria. Ebermaier was the first to call attention to the typhoid bacillus soon leaving the blood-stream and seeking refuge in the bone-marrow. From the marrow of a piece of rib secured at the autopsy upon a man who had died of intestinal hemorrhage he grew in culture media a few colonies of this microbe. A striking peculiarity of this habit, however, is the lack of development of manifest focal disturbances. Unless it becomes activated the host is oblivious of being a carrier. Why these bacilli, after varying periods of latency, are suddenly aroused into pernicious activity, no one has as yet satisfactorily explained. Keen believes muscle strain is a sufficient provocation to arouse their malevolent tendencies; Bondet [5] attributes it to slight traumata incurred by the use of the ice baths, and Fogh,[6] amongst others, to a blow. LeFilliatre [7] has seen it follow fatigue. Mouisset [8] mentions it as having occurred at the site of an old fracture, and Finlayson [9] in the scar of a tubercular lesion.

While typhoidal osteomyelitis may occur during the fever or in unusual instances after the lapse of years, the period of defervescence is the commonest time. Bunts [10] reports the recovery of a pure culture of typhoid from a tibial abscess, seventeen years after the appearance of the attack. Fogh [6] mentions their existence for twenty-three years in the femur; Tubby and Hicks,[11] for thirteen years in the ulna; Gore,[12] for eleven years in the frontal bone, and a number of observers for periods ranging from a year upwards. More mysti-

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fying, however, are those cases with open sinuses for months and years which yield a pure culture of the typhoid bacillus. According to the modern concepts of bacteriology when drainage exists the original typhoid infection should be crowded out by the pyogenic cocci; yet Sultan [13] reports a case in which a pure culture of the bacillus typhosus was obtained from an open sinus of six years standing, and Parsons [14] a case from the pus of which at operation the typhoid bacillus alone was grown, but from the resulting sinus, six weeks later the B. typhoideus associated with the staphylococcus pyogenes aureus.

As long as a person shelters a single bacillus, he is a menace not only to himself but also to the community. The supposition is that from time to time bacterial emboli are swept into the blood-stream to find lodgment at other points or to be filtered out by the kidney and passed in the urine. To this behavior is attributed the successive metastatic bone explosions. Bigelow,[15] has reported an instance of a typhoidal sinus acting as a source of infection to others. Fruit handled by the patient served as the intermediate agent. The intensity of the primary attack does not have any particular influence on the severity of the bone lesion. A mild case may be followed by a very acute osteomyelitis and vice versa.

The disease is scarcely ever acute, almost always chronic. Although only one bone is usually involved, it is not uncommon for more than one bone to be attacked either simultaneously or successively. Frequently there are several consecutive periods of activity succeeded by symptomless intervals, after any of which resolution or suppuration may occur. As a rule constitutional symptoms, if any, are trivial. Fever is generally absent, but occasionally there is a moderate rise in temperature. The initial symptom is pain followed by tenderness and swelling in one or more bones. At first the pain is vaguely seated and fleeting, but it soon localizes and becomes lancinating and is more acute at night than during the day. The least pressure exacerbates it. Not until some days after the onset of the pain does tumefaction appear. The lump develops slowly and is usually limited to a small area. In a few cases the pain is the sole symptom of the bone involvement. Even after weeks or occasionally years of freedom from symptoms the pain and swelling may reappear at the same or another site and abscess form. More than one such oscillation may occur, followed by complete cure or suppuration. The skin at first is healthy. Only later does it become thin, violaceous and fixed. If abscess occurs, fluctuation may be detected. Local heat is but rarely present. The leucocyte count is usually within normal limits, but a leucocytosis of 15,000 to 20,000 has been observed with a polymorphonuclear ratio up to 89 per cent. According to Matthes, a persistent bradycardia in inflammatory bone disease is indicative of a typhoidal infection. The presence of this sign in an arthritis suggested to him the possibility of its typhoidal origin. The correctness of the impression was confirmed by bacteriological studies made after the death of the patient, who had had typhoid fever fifteen years previously. Any or all of the bony constituents

may be involved, thus has arisen the various terms used in describing the malady, *viz.*, periostitis, osteo-periostitis; osteomyelitis, bone abscess, etc. A periostitis may terminate by the formation of exostoses. The tibia, femur and ribs in the order named. are the bones most often attacked, but no bone is immune.

This affection has been mistaken for luetic, tubercular, sarcomatous and the common pyogenic bone diseases. Syphilitic involvement of the long bones, the tibia and femur excepted, is unusual. Lues is preëminently a disease of the flat bones. When the long bones are affected there is a marked tendency to bowing. Its symptoms are less acute; the osteoscopic pain more pronounced and suppuration more infrequent than those consecutive to typhoid. A positive Wassermann test, a characteristic luetic skiagraph, a history of a syphilitic taint and a benignant anti-luetic treatment are most helpful in cases of doubt. Tuberculosis preëmpts the epiphysis. Seldom, if ever, does it involve the shaft primarily. Pyoccocic osteomyelitis occurs at the same age as the bone lesions consecutive to typhoid and like the latter by preference attacks the tibia; but typhoid osteitis is always preceded by enteric fever, its evolution is not so rapid, its fever as high, the leucocytosis as marked or the pain and tenderness as intense. Sarcoma announces itself by tumor formation evident to both sight and touch, as well as by the distinctive radiograph.

The disease usually runs a benign course. Either the plastic or the suppurative type may subside spontaneously. There is a marked tendency, however to chronicity. Amongst others, Klemm,[16, 17, 18, 19] Würtz,[20] and Urbantschitsch [21] have reported fatalities.

Prevention is rather to be desired than cure. Patients recovering from typhoid fever should be warned against injury to the osseous system and fatigue. For pain, repose in bed, friction and hot compresses have been used with success. The question of surgical intervention is largely a matter of judgment. Some cases resolve spontaneously; others are cured by simple incision and drainage and still others require repeated operations before the disease is finally brought under control. Especially is this true of incomplete operations upon the costal cartilages. As a rule the entire cartilage must be excised to obtain a permanent cure. Insufficient operations lead to sinus formation which may persist for years before finally closing. Whenever operation is undertaken, the medullary canal should be opened, otherwise hidden pockets of pus and sequestra containing cavities may be overlooked, thereby subjecting the patient to an ineffective ordeal. Most surgeons have thought it necessary to drain these wounds, but Unger,[22] Dupraz,[23] and Lilienthal,[24, 25] closed their incisions and obtained healing by first intention.

The status of vaccine treatment is still unsettled. Some observers have reported remarkable results. Sharpless,[26] Rosenberger,[27] Emile-Weil,[28] Sicard and Robineau,[29] and Dachtler,[30] have conclusively shown that under the influence of vaccines typhoidal osteomyelitis can be cured with the great-

est rapidity. Emile-Weil [28] has treated eighteen cases with stock solutions of triple vaccine, two of which were consecutive to paratyphoid B. An account of these cases has been incorporated by Chéron (Thèse, Paris, 1921) into his inaugural thesis. The reports of five of these cases were published in the early part of 1917, with the following results: Cure in three weeks of a suppurative typhoidal fistula of two years duration after seven operations had proven futile; cure in one week of a patient suffering for eleven months after three unsuccessful operations; amelioration in two cases after fifteen days of treatment; failure in a single instance only. Later in 1917, in conjunction with Chęvrier he records seven additional cases. Two non-suppurative cases treated with vaccines alone had remained completely cured more than six months. Of the suppurative, one was cured, two improved and two unsuccessful. The injection may be made into the lesion or at a distance. Sicard recommends sixteen injections at two day intervals. Sharpless injected first 90,000,000 dead bacilli, followed at ten day intervals by 180,000,000. Rosenberger closed a fistula after seven injections of an autogenous vaccine.

The purpose of this paper is to call attention to osteomyelitis as a relic of typhoid fever; to tabulate the cases in which the B. typhosus has been found and in particular to place on record two additional cases.

Case Reports. CASE I.—A white female, aged twenty-four, entered the University Hospital, Baltimore, October 11, 1921, for a soreness in the right thigh. Two years ago last August, she had had a typhoid fever of 8 weeks' duration. Her convalescence was uneventful until 8 weeks after defervescence when she was suddenly seized with a lancinating pain in the lower part of the right thigh. After a few days this ceased as suddenly as it appeared. In January, 1921, she was delivered instrumentally of a full term but dead infant. The death was attributed by the physician in attendance to the length of the labor, not to a constitutional diathesis. No ill results followed the confinement and the patient was about her household duties in the usual time. Three months later while apparently enjoying the best of health, she experienced, without warning, a repetition of the pain. Like the first attack, this gradually subsided. Since the initial attack there have been five distinct recrudescences of the complaint, similar in all respects to the first but less severe.

The present attack began 6 weeks ago. Three days after its inception she had a chill. Her condition gradually became worse and two weeks ago she had to go to bed. Even with the leg at rest the pain did not subside and she sought the hospital for relief. Upon examination the affected leg looked normal; the skin was natural in appearance and the soft tissues not noticeably swollen. Deep pressure over the middle and inner aspect of the femur caused intense suffering. At this point the right thigh measured 16½ inches, the left 15¾. The femur itself appeared thickened. The knee could be flexed voluntarily, but the act was very painful. By October 18th, the local symptoms had all become accentuated and fluctuation was definitely determined. The temperature had ranged since admission between 99° and 101° F. No history of traumatism could be elicited. The blood Wassermann was negative; the Widal negative; the leucocytes 20,000 with a ratio of 89 per cent. polymorphonuclears, 10 per cent. small mononuclears, and 1 per cent. large mononuclears. The radiographer reported thickening and roughening of the periosteum along the middle third of the shaft of the femur suggesting an osteomyelitis. Despite the high leucocytosis and the negative

Widal, the history of a preceding typhoid followed by numerous attacks of pain in the bone with periods of activity and quiescence led to a diagnosis of post-typhoid osteomyelitis for the relief of which an operation was advised.

On October 19, 1921, with the patient under ether, Dr. A. M. Shipley, incised the abscess and a quart of yellowish-green, odorless pus escaped. The femur lay freely exposed in the abscess cavity. The periosteal covering of this bone had been completely destroyed. Several small sequestra were seen protruding from it. These were removed. A hole was bored into the medullary canal and a considerable amount of flaky pus set free. A second trephining was made about two inches above the first and rubber tubes were inserted for Dakinizing purposes. The abscess cavity was packed with plain gauze. September 1, 1922, the patient reported the wound was still discharging. Cultures made from the pus obtained at the operation grew the typhoid bacillus alone.†

Case II.—A white man, aged seventy, entered the University Hospital, February 3, 1921, for relief from a discharging sinus in the lower and front part of the right side of the chest. He had had an uncomplicated attack of typhoid fever in the summer of 1920. The first intimation of anything wrong was during convalescence when he noticed a tenderness at the site indicated. The discomfort instead of improving gradually increased; the skin became red and glistening; an abscess finally formed and broke open. On admission there was seen over the 8th costal cartilage near the sternal margin a sinus from which pus exuded. The temperature was 98; pulse 60; respiration 20. An X-ray examination did not reveal necrosis of either the rib or cartilage. The clinical impression was post-typhoid perichondritis. Operation, February 3, 1921, by Doctor Shipley. As the man's condition did not warrant a general anæsthetic, the operation was done under local anæsthesia (0.5 procaine solution). The sinus was freely opened down to the cartilage of the 8th rib which was found to be the seat of a suppurative perichondritis. The diseased portion of the cartilage was excised; the soft tissues thoroughly curetted and three Carrel tubes inserted. The sinus persisted, however, until July 28, 1922, when it closed spontaneously, never to reopen. In this case no cultures were made until 9 months after the operation. Despite the existence of a sinus during all this time, the culture yielded the B. typhosus alone.

A third case, undoubtedly typhoidal in origin, came under my care during the same period. The patient, a white female, had had a typical attack of typhoid fever two years previously from which she made an uncomplicated recovery and was well for a year and a half subsequently, when her attention was directed to a painful lump over the 6th left costal cartilage near the sternal end. Gradually but progressively the mass increased until it had reached the size of a hen's egg. It was round, tense, non-fluctuating and apparently fixed at its base to the rib cartilage, but not very sensitive to touch. The overlying skin was bulging, but not inflamed. The woman's general health was unimpaired. Though the patient was told that the mass was probably a typhoidal chondritis, she feared cancer and demanded its removal. So on June 5, 1921, under ether anæsthesia, an incision was made into the mass permitting the escape of a few drops of a thick, odorless, sticky, creamy pus. The entire cartilage together with a portion of the adjoining rib and sternum was excised and the wound closed with the exception of a small aperture for the emergence of a gauze wick. A rapid cure resulted and the patient reported October 10, 1922, she had had no further recurrence of the trouble. Cultures were not made because the operation was done in the patient's home.

† A recent note from the patient states that the wound has closed and she is entirely well.

In my search of the literature, I could find only 101 cases of bacteriologically proven osteomyelitis due entirely or in part to the B. typhosus. An analysis of their salient features gives the following information:

Sex: Males 65: Females 29: Not given 7.

Age, number in each decade

1–10	10–20	20–30	30–40	40–50	50–60	60–70	70–80	Man	Boy	Girl	Not given
4	20	26	16	12	1	2	1	8	2	1	8

The youngest patient was 2 years old, the oldest 70. Twenty-four were under 20; 50 under 30 and 32 over 30; the remainder were merely described as man, boy, girl or not at all.

Bacteriological findings

Bacillus typhosus alone	94
Bacillus typhosus and bacillus coli communis	2
Bacillus typhosus and staphylococcus pyogenes aureus	1
Bacillus typhosus and streptococcus pyogenes	2
Bacillus typhosus and staphylococcus pyogenes citreus	1
Bacillus typhosus and pneumococcus	1

Number of bones attacked in each case

1 bone	68
2 bones	23
3 bones	2
4 bones	2
5 bones	4
6 bones	2

These figures show a total of 160 bone lesions in the 101 patients.

Bone attacked and number of times

Tibia	56
Femur	27
Ribs and costal cartilages	27
Ulna	9
Radius	7
Mastoid	6
Sternum	4
Metacarpal	4
Clavicle	4
Humerus	3
Metatarsal	3
Parietal	3
Phalanx (hand)	2
Temporal	1
Ilium	1
Frontal	1
Pubic	1
Fibula	1

Metastasis to the costal cartilages

Under 20	1
20–30	5
30–40	6
40–50	9
50–60	0
60 70	1
70–80	1
Young man	1
Not given	3

While infection of the skeletal system in general shows a predilection for people under 30, that of the costal cartilages occurs more frequently at a later period, namely 6 below and 17 over 30.

The time of onset of the bone manifestation was:

During attack	9
First two weeks of convalescence	11
2nd to 6th week of convalescence	8
During convalescence (time not specified)	53
Months or years after convalescence	20

The lesions varied from small superficial areas of caries to extensive destruction of the bone.

Progress

Died	Cured	Healing	Bone still enlarged	Persisting sinus	Not stated
9	48	8	1	10	25

Four patients required 2 operations before cured and one submitted to 3 operations.

Eighteen were of the acute type; 83 chronic.

When sequestra were met with, they were described as small and were rarely over an inch long.

Seldom was the diagnosis made or even suspected before the bacteriology of the pus was investigated.

I did not find a single example of vertebral abscess substantiated by bacteriological examination. Raymond and Sicard[31] mention having performed a laminectomy for an extradural lumbar abscess, but take pains to specify that the bone was not diseased. Guyot[32] attributed a lumbar abscess to the ravages of typhoid but said the patient did not present anything abnormal in the backbone, nor did he make any bacteriological study of the pus.

Seven cases were reported as having followed an injury and one at the site of an old fracture.

Bigelow tells us of 3 people having been infected with typhoid by a man with a sternal sinus.

It is indeed remarkable, a disease as relatively common, as crippling, as stubborn to treatment as typhoid osteomyelitis has received so little attention.

CONCLUSIONS

1. Persistent bone pain with the history of a previous typhoid fever should suggest the possibility of a typhoidal osteomyelitis.

2. In suppurative bone disease a careful investigation of the bacteriology of the pus is necessary for an accurate diagnosis.

3. When suppuration occurs surgery offers the patient the surest and quickest road to complete cure.

4. Vaccino-therapy has been used with success in a few cases, both suppurative and nonsuppurative, with and without operation.

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RADICAL OPERATION FOR CHRONIC EMPYEMA*

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In a recent article on chronic empyema † I have enumerated the various causes, both predisposing and real, which lead to chronicity. In the same paper I have dealt with the question of conservative treatment and with the treatment of superficial post-empyemic fistulæ.

This paper deals with the treatment of deep sinuses and cavities which have resisted such conservative measures, and it is therefore to be looked upon as a continuation of the above-mentioned article.

It is my belief that the majority of patients suffering from chronic empyema will get well by the establishment of good drainage, aided by artificial sterilization of the cavity and attention to their general condition and hygiene. But in spite of these measures some patients refuse to heal. This applies not alone to those in whom it was impossible to sterilize the cavity, but also to those in whom superficial sterility had been obtained by the use of Dakin solution. I say superficial or surface sterility because none of the solutions used for irrigation are able to produce sterility of the deeper layers of the lining of a chronic empyema cavity. This is one of the reasons for non-healing and recurrence. Other reasons are found in the mechanics of the thorax, such as a rigid thoracic wall, a collapsed lung, a firm, unyielding pleura, pockets and recesses in connection with the empyema cavity, which are inaccessible to treatment, bronchial communications and tuberculosis.

The operative procedures necessary to bring these patients to a complete cure consist of more than simple drainage and irrigation. It is necessary to remove the obstacles to healing, be they an infected lining of the cavity, an unyielding pleura, narrow recesses, a rigid thoracic wall, a bronchial communication or tuberculosis. Not the same methods of treatment are indicated in all cases, nor is it always necessary to sacrifice a large number of ribs. The term radical operation is here used to indicate an attempt at the radical removal of the causes of non-healing, not as an attempt to produce complete collapse of the chest wall.

This paper deals with 146 cases on which I have operated to date. The group includes cases from army and civil practice. Most of them had drained for from six months to two years, the longest twelve years. Nearly all patients had been under the care of a number of surgeons, and different forms of treatment had been tried. Most of them had been continuously on Dakin-Carrel treatment, some had had one or more radical operations and a few

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were quite mutilated. They were very rebellious cases that showed no tendency to heal, whether the cavity was sterile or not. The decision to operate was based not alone on the length of time a patient had drained, but rather on the local condition found. It has been our aim to diagnose the condition as nearly as possible, and then institute that operative procedure calculated to cure it. For this reason all patients were subjected to thorough physical examination, laboratory study and examination with the X-ray, both without and with bismuth injection of the cavity. In this way it was possible to place them into one or the other of the groups described below. One should never attempt a radical operation with the idea of dealing with conditions as they are found during operation, but instead study the case carefully in advance and then plan the operation according to indications. To do the operation speedily, and with as little shock as possible, one should plan big and then go ahead and do it, not resect a rib or two, putter around and finally decide to resect another.

The element of time alone is not sufficient to determine whether a radical operation is indicated, for even very old cases may sometimes be healed by the establishment of good drainage aided by Dakin-Carrel treatment. However, if after the establishment of good drainage, a patient shows no tendency to heal, long after the time that it usually takes empyema patients to heal, and one recognizes faulty local conditions that are not likely to yield to conservative measures, operation is indicated. Whether it should be done at that time depends on the general condition of the patient. If he is still anæmic and undernourished, one must wait, because any radical operation is apt to be connected with considerable shock. Conditions being favorable, the operation is advised.

Previous to operation all patients who had not been so treated were put on intensive Dakin-Carrel treatment, with the establishment of good drainage. The severity of the infection was controlled by frequent culture of the secretions. Two objects were followed, either to bring about healing by these means, or if that failed, to have the field clean for a radical operation.

With the exception of a few, in which there was a distinct contra-indication, all cases were operated on under general ether anæsthesia. No differential pressure apparatus is required because the lung either has been collapsed for a long time, and the patient has accommodated to it, or if the lung is compressed, extensive adhesions will prevent complete collapse after operation.

There are several main groups of cases.

1. Cases with an empyema cavity communicating with the surface by a narrow sinus.

2. Cases with a long irregular sinus, often reaching from the opening in the chest-wall to the apex of the thorax.

3. Cases with an ordinary chronic empyema cavity, the walls of which are so rigid that healing can not take place, or the walls of which are so infected that it is impossible to sterilize them.

4. Cases with a chronic empyema cavity that has communicating pockets or recesses which are not accessible to treatment.

5. Cases with a chronic pneumothorax.

6. Cases with bronchial communications.

7. Cases with tuberculosis.

Group I.—Cases with an empyema cavity communicating with the outside by a narrow sinus.

Reference is made to only those cases in which the drainage is considered dependent and adequate, and which have been on Dakin-Carrel treatment without attaining the desired result. This group comprises twenty cases. These are often patients in whom drainage was established too low. As healing progressed the costo-phrenic sinus became obliterated, the diaphragm approached the thoracic wall and a narrow sinus developed, with more or less valvular action. Pus collections in the mediastinum or in the upper thorax, finding their exit on the lateral thoracic wall, also belong in this class. The treatment consists in the radical extirpation of the entire fistula together with all surrounding tissue, until a large opening into the cavity is obtained. The incision is so placed as to surround the fistula, the muscles are pushed back and a portion of from two to four ribs is resected, depending on the case. Usually only short pieces, two to three inches in length, have to be sacrificed. The entire fistulous tract, with its surrounding skin, new-formed bone, and thickened pleura, is excised in one piece. All tissue which harbors infection and which has been the cause of re-infecting the cavity, is thus removed, and a large opening into the cavity obtained. The latter is then examined to determine that it is smooth and clean, and that no foreign body is present. After this Carrel tubes are inserted, together with a large outlet tube, and muscles and skin partly closed. Dakin-Carrel treatment is started at once and continued in the regulation manner until sterility of the cavity is obtained, when it is allowed to close. In this group of twenty cases there was no mortality. Several healed in four weeks, while others took somewhat longer, one continuing to drain for three months. All but four patients, about whom we have not been able to get information, have healed and remained well.

In suitable cases this method gives excellent results; it is not associated with shock and produces no deformity.

Group II.—Cases with intractable deep sinuses.

Group III.—Cases with a rigid chronic empyema cavity having infected walls.

Group IV.—Cases with an empyema cavity having communicating pockets or recesses.

The treatment of these three groups may be considered under one heading, because the principles underlying it are the same, though the details of the operation may vary. Whether one deals with a deep sinus or a cavity makes no difference, for the former simply represents a more advanced process. Healing has failed to take place owing to one factor or several existing at the

same time. The walls are so rigid that they are unable to meet, the lining may be infected in its deeper layers and lead to re-infection of the cavity, either immediately or after temporary healing, thus producing a recurrence. Narrow recesses harboring infection may communicate with the cavity and constantly lead to re-infection.

The object of the operation is to overcome or remove these various conditions. In order to do that it is necessary to mobilize the chest wall,

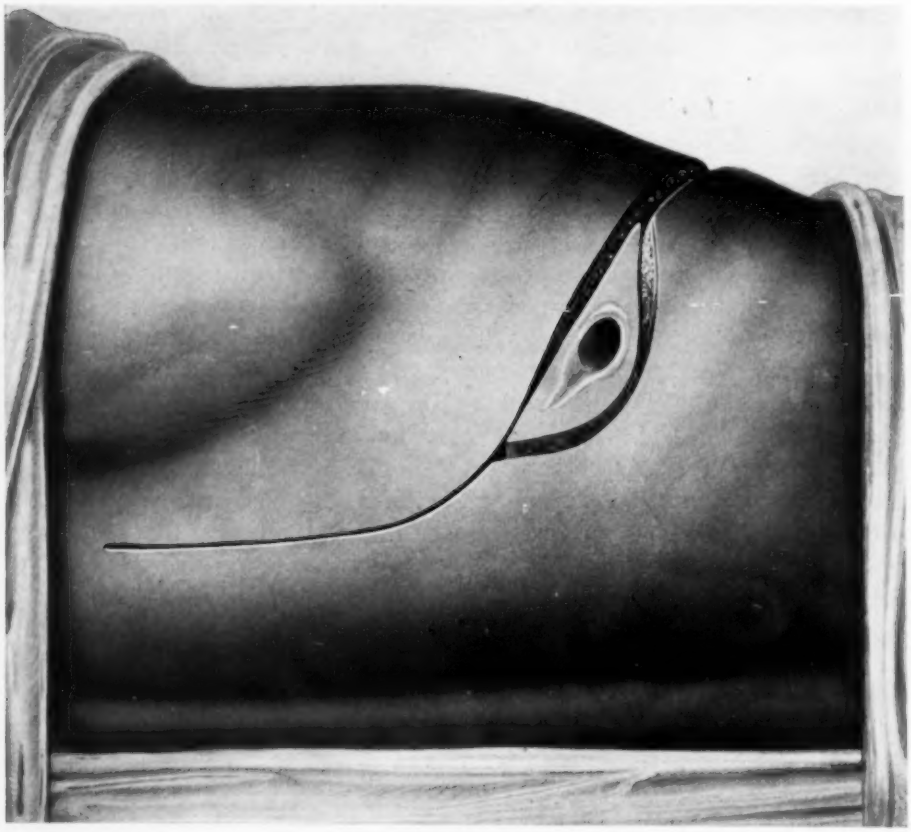


FIG. 1.—Line of incision in a typical case.

mobilize the lung, and completely remove all infected tissue lining the cavity. It has been, and is still, our belief that one should not depend on mobilization of the chest wall as the principal aid, but rather on the thorough mobilization of the lung to such a degree that it is again able to expand to the limits of the chest wall. The operation is planned and carried out with this object in view.

Most cavities and sinuses run up posteriorly, and in a typical case the incision is therefore so placed that its upper end will correspond with the upper end of the cavity. It is usually begun midway between the inner

border of the scapula and the spine, carried downward to encircle the fistulous opening and scar, and ends below and forward at the lowest limit of the cavity (Fig. 1). The muscles are then divided in a similar way and pushed upward, carrying along the scapula, so that the necessary portion of the bony chest wall is exposed (Fig. 2). By placing the patient as shown in Fig. 3, the arm of the affected side can be moved upward, carrying along the scapula, so that ample exposure is obtained. Portions of the

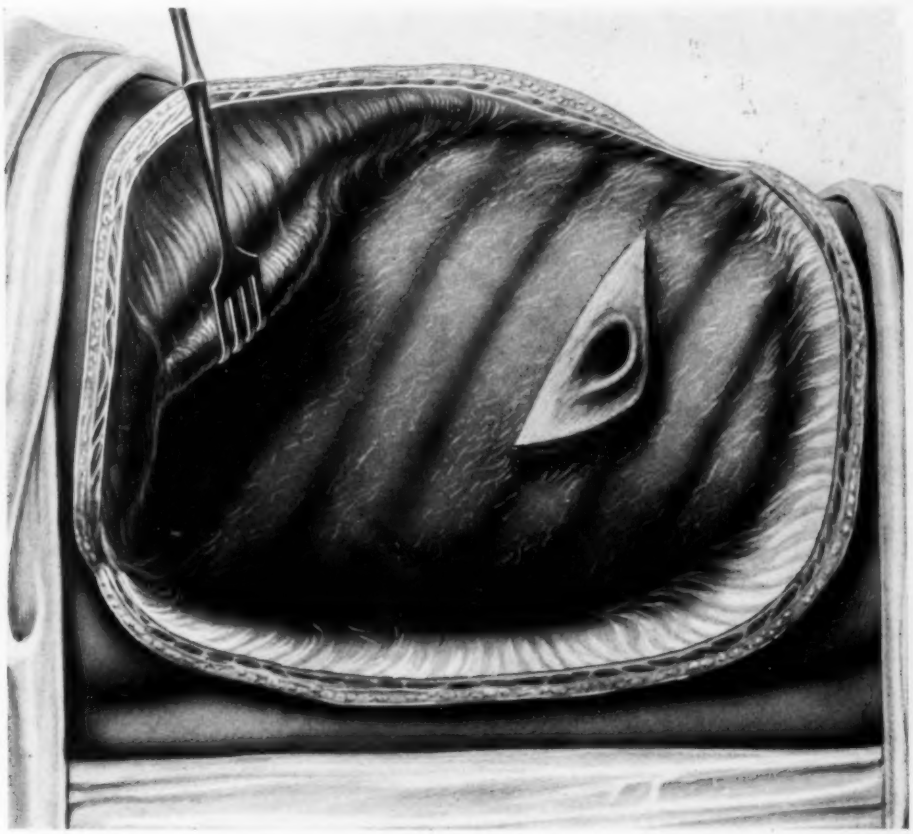


FIG. 2.—Muscles and skin pushed back exposing ribs.

ribs overlying the cavity are now removed in rapid succession. In these chronic cases this is never easy, and sometimes very difficult, especially in those patients in whom parts of several ribs have been removed during former operations. In these cases there is often fusion of several ribs and complete bony rings or even plates have formed. In addition to this the internal surface of that portion of the ribs overlying the cavity has often become very much thickened by periostitis, and this new-formed bone is firmly embedded in the wall of the cavity. The ribs instead of being flat are triangular in shape. To avoid spreading infection it is our object to remove the fused bone with inter-

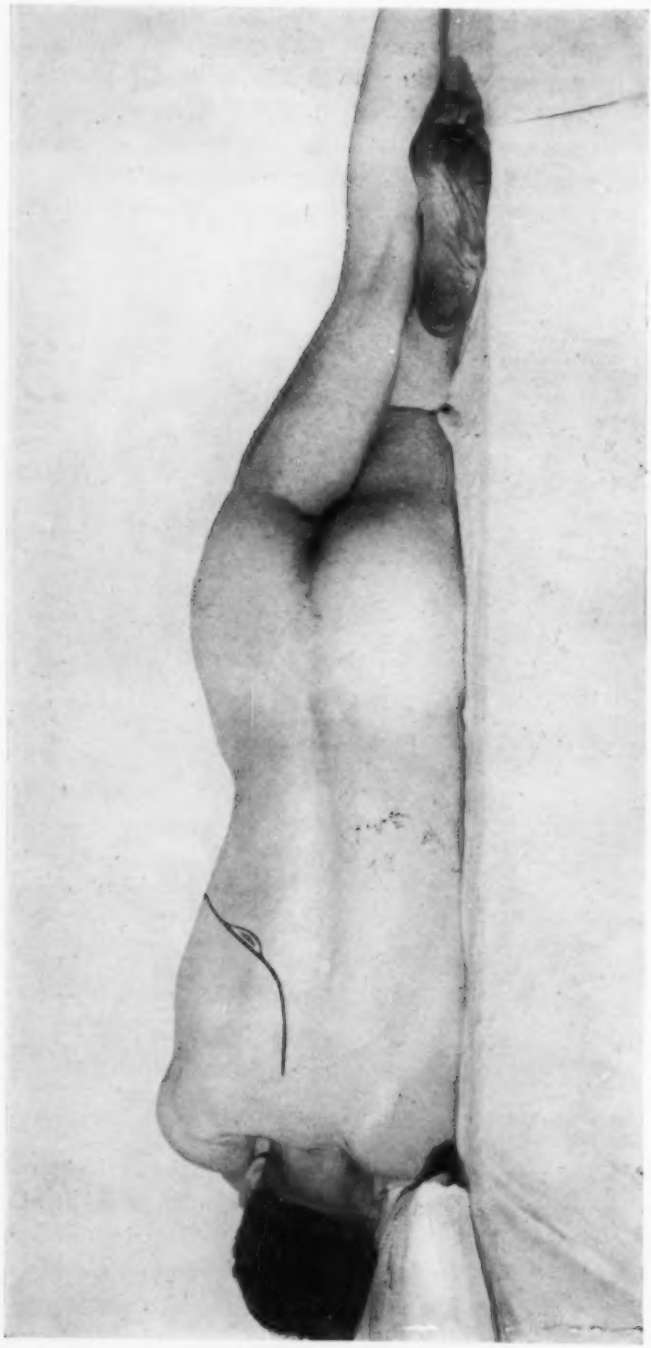


FIG. 3.—Position of patient which allows rolling him forward or backward.

vening infected tissue, and the fistula in one piece. Separating the ribs is made easier if one uses the periosteal elevator along their upper border from behind forward, and along their inferior border in the opposite direction.

In those patients who have previously had a more or less radical operation, it is found that the anterior ends of ribs are flat and easily separated, while the posterior ends are thick, nodular, and difficult to remove. It appears that growth of bone takes place principally in the posterior ends, probably because the nutrient artery enters that portion. As mentioned before, the object of this operation is not to bring about collapse of the chest wall, but simply to mobilize it. For this reason it is necessary to remove but short pieces of rib. Because the intervening intercostal tissues may be the seat of

infection, and interfere with a thorough operation, they are also removed, after ligating them just beyond the bony ends. After removing the necessary bone and intercostal tissue the outer wall of the fistula or cavity is exposed, and it is now possible to split it upward to its upper limit (Fig. 4). This outer wall represents the parietal pleura. It is usually one-fourth to one-half inch thick, but occasionally reaches a thickness of three-quarters inch. It

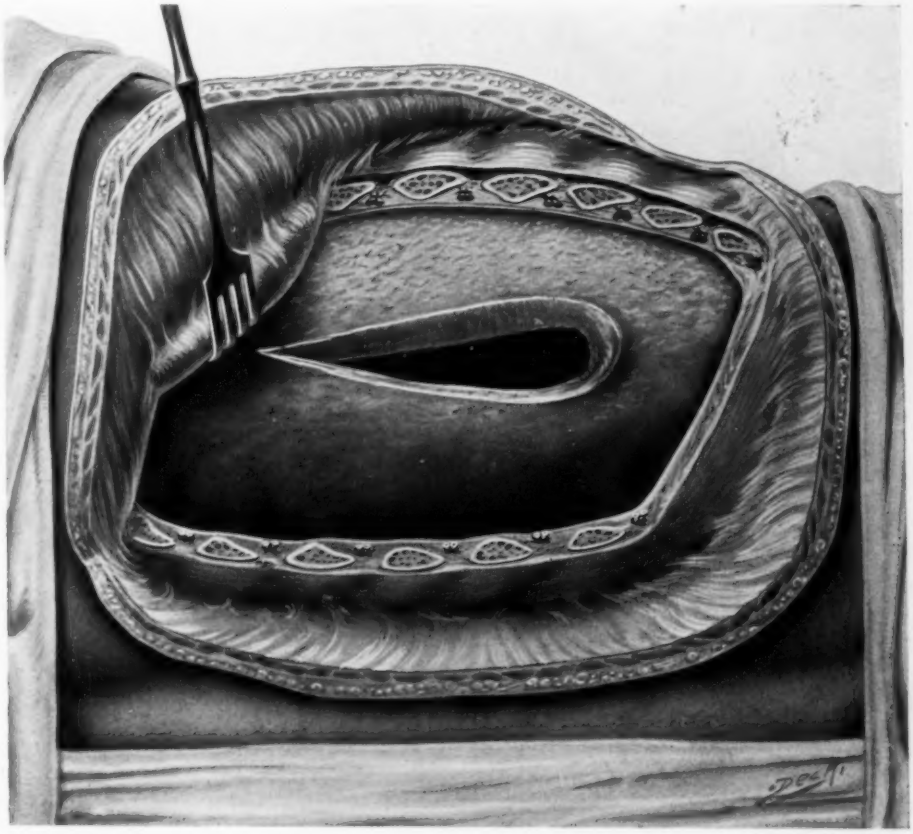


FIG. 4.—Outer wall of cavity exposed and split upward.

is firm and frequently cuts like cartilage. This wall is now removed in its entirety, exposing the floor of the cavity. The latter is dried and carefully inspected for recesses or pockets extending beyond the main cavity. Even with bismuth injections these recesses sometimes do not show up, and it is therefore important to be watchful during the entire course of the operation. A little area of pouting granulations may indicate the opening into one of these extensions. They may be found at any part of the cavity, extending upward, or towards the mediastinum. The most common ones are those extending from the lower part of the cavity into the costo-phrenic sinus, either forward or backward. They serve to explain why cavities never

become sterile or healed. The X-ray of patient B (Fig. 12), who had a chronic empyema for twelve years, shows bismuth in such small club-shaped cavity situated in the extreme anterior end of the costo-phrenic sinus. Part of the costal cartilages had to be removed to gain access to it. These

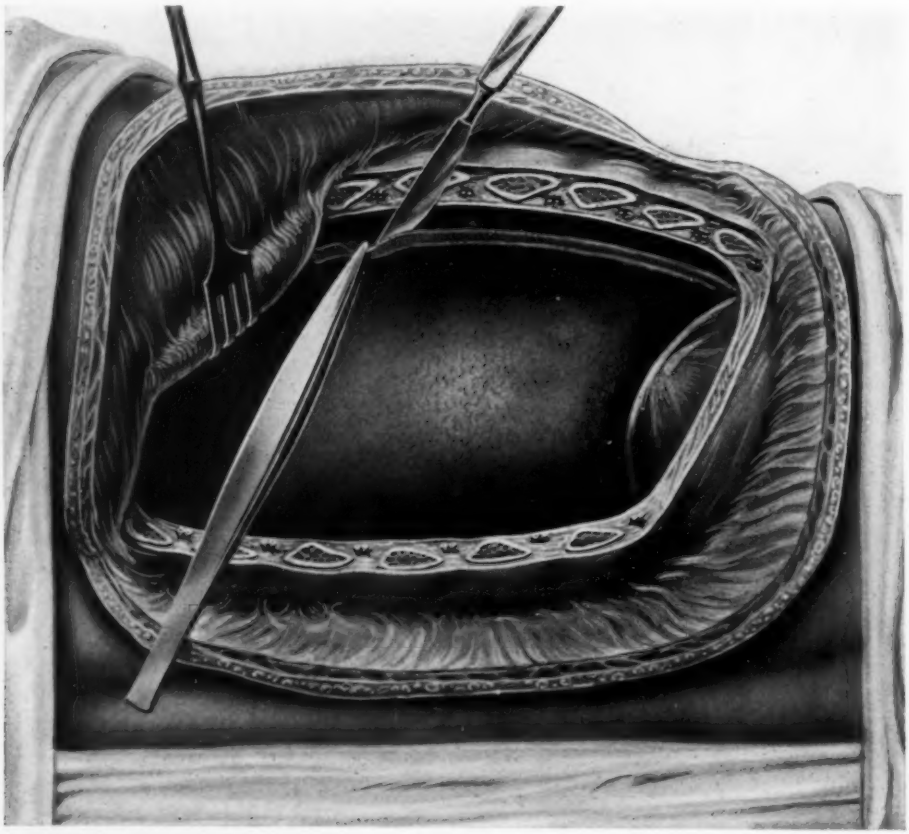


FIG. 5.—Outer wall removed. Dissection of angle of reflection of pleura being started.

recesses must be completely extirpated, because they harbor infection and lead to re-infection of cavities.

Inspection of the floor of the cavity may show absolute immobility, but usually respiratory movements are noticed in the central part, while there are none towards the margin, where the lung is fixed by dense connective tissue, holding it to the chest wall. The most important step in the operation, the removal of this dense tissue, is now begun (Fig. 5). Starting at the margin of the cavity, where we left off after removing the outer or parietal layer, the dissection is carried towards the lung. A mouse-toothed forceps and a sharp knife are the best instruments for this purpose. As soon as this incision has been carried around the margins of the cavity, and the lung is reached, increased mobility of the latter is noted. At this stage it is well to

remove the tissue so liberated, and then with increased caution proceed to decorticate the lung itself. In some cases this is easy, and one may even bluntly shell off the inflammatory layer covering the lung. In other cases it is extremely difficult, and one succeeds in removing only narrow strips near the margin, while in the central portion the covering is so thin that there is nothing to strip off. It is my belief, that although one speaks of

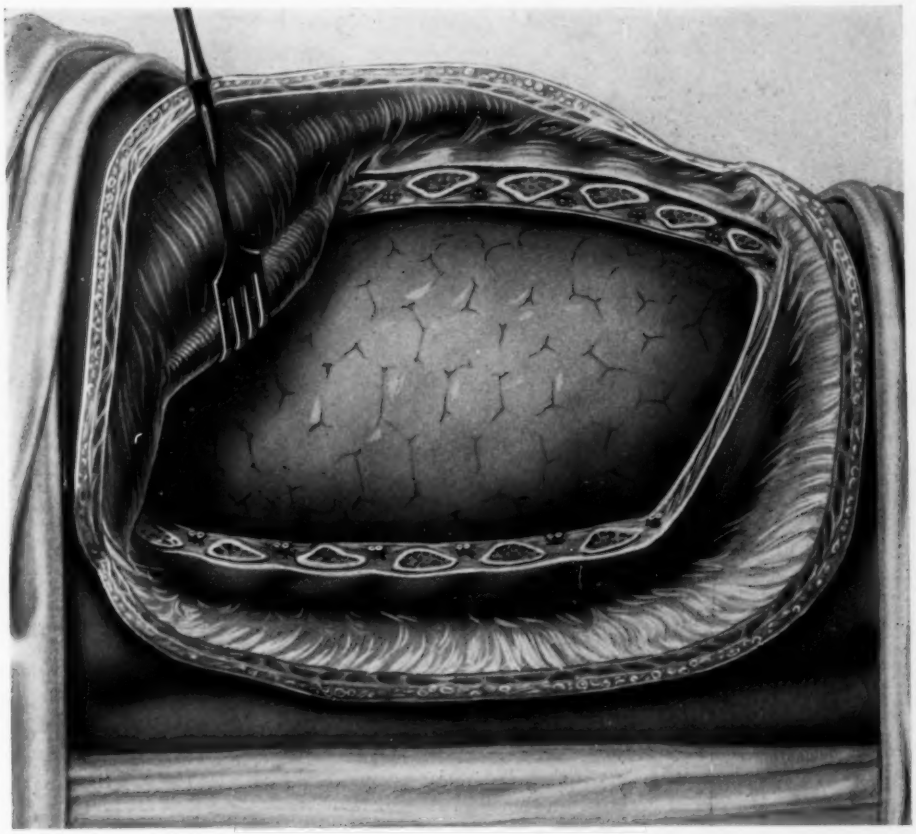


FIG. 6.—Lung completely decorticated and expanded. Wound ready for closure.

removing the visceral pleura, the tissue that is actually removed is not visceral pleura, but a layer of inflammatory tissue covering it, leaving the pleura itself more or less intact. In some patients, however, visceral pleura and inflammatory layer are so closely incorporated as to make their removal impossible. Under these circumstances criss-cross incisions as recommended by Ransohoff are resorted to. As soon as made, these incisions promptly spread, thus allowing expansion of the lung. With the finger one may now bluntly separate the lung a little more from the chest wall and diaphragm, and it is surprising how beautifully it often expands, though it may have been compressed for years. At this stage of the operation we allow the

anæsthesia to become more superficial and we encourage the patient to strain by inserting a spatula into the back part of his throat. During these straining efforts a lung which looks dark owing to poor aëration from compression will expand and become pink in color. Sometimes it even becomes necessary to hold it down with hot pads because it tends to expand beyond the limits of the chest wall. These are very favorable cases, and one depends on this

FIG. 7.—Wound being closed, drainage established at lowest part of cavity.

reëxpansion chiefly to bring about obliteration of the cavity. In other cases, owing to fibrous changes that have taken place in the lung tissue, expansion is poor, even though the lung is completely mobilized. These are less favorable cases, and one has to depend chiefly on the mobilization of the chest wall to bring about healing. Having removed all inflammatory tissue, including recesses, one finds a clean diaphragm, and a clean lung, and after drying out the wound, one is ready for closure (Fig. 6). The more accurately the dissection has been carried out, and with the least damage to vital structures, the better the result.

Closure of the wound is effected by approximating the muscles with interrupted chromic gut sutures, and then closing the skin with silkworm gut. One or two short drainage tubes are inserted at the dependent part of the cavity. As the latter frequently extends somewhat below the line of incision, a short vertical incision is added and the drainage tubes brought out through this opening (Fig. 7). A dry dressing is applied, held in place by means of a binder. In case the scapular muscles have been divided, a second binder is applied, which holds the arm to the side of the body. So-called pneumonia jackets are excellent for this purpose.

The immediate after-treatment consists in the administration of a hot coffee enema of six ounces containing half an ounce of whisky and one-fifteenth grain of strychnine. Stimulation and hypodermoclysis are ordered if indicated. Hypodermoclysis should be given under the skin of the inner side of the thighs so as not to interfere with respiration. Morphine is given freely during the first few days.

There is usually considerable serous or sero-sanguineous discharge during the first few days, which, however, quickly subsides if the wound remains sterile. The further treatment depends on the course. If the discharge is sterile, and remains so, we remove the drainage tube in a few days and obtain early closure of the wound. Such cases are illustrated by patient T (Fig. 8). If organisms are present in the discharge, and it is turbid, we give one Dakin irrigation every morning, not beginning before a week has passed, however, to prevent fluid and possibly infection being carried into the deeper parts of the wound. If real pus develops, as is more likely the case in those patients, in whom an incomplete decortication was done, regular Dakin-Carrel treatment is instituted.

All patients are encouraged to sit up early, to breathe deeply, and to get out of bed in from three to seven days. The use of blow-bottles is begun early, to maintain the regular aëration of the lungs which was begun on the operating table. Sutures are removed on the seventh day, and as soon as the wound is firm, light arm exercises are carried out in addition to deep breathing.

I have treated 99 cases by the method just described. Some were comparatively easy, while others were extremely difficult. When it is realized that chronic empyema is a disease in which conditions vary a great deal, it becomes evident that the operation has to be varied to meet these conditions. Some patients have several drainage openings, a low one, a high one, and perhaps another one in front. Still others have extensive fusion of ribs, or one finds a wide open thorax, the result of former radical operations. Instead of the typical cavity situated low, and extending up posteriorly, we had quite a number of patients with a cavity in the upper thorax, or with an extension toward the mediastinum. In some patients, especially those with a small cavity and good muscular development, we have turned the edges of the muscles into the cavity to aid in obliterating it. In seven patients we found a foreign body, rubber tubing in four, and in one each

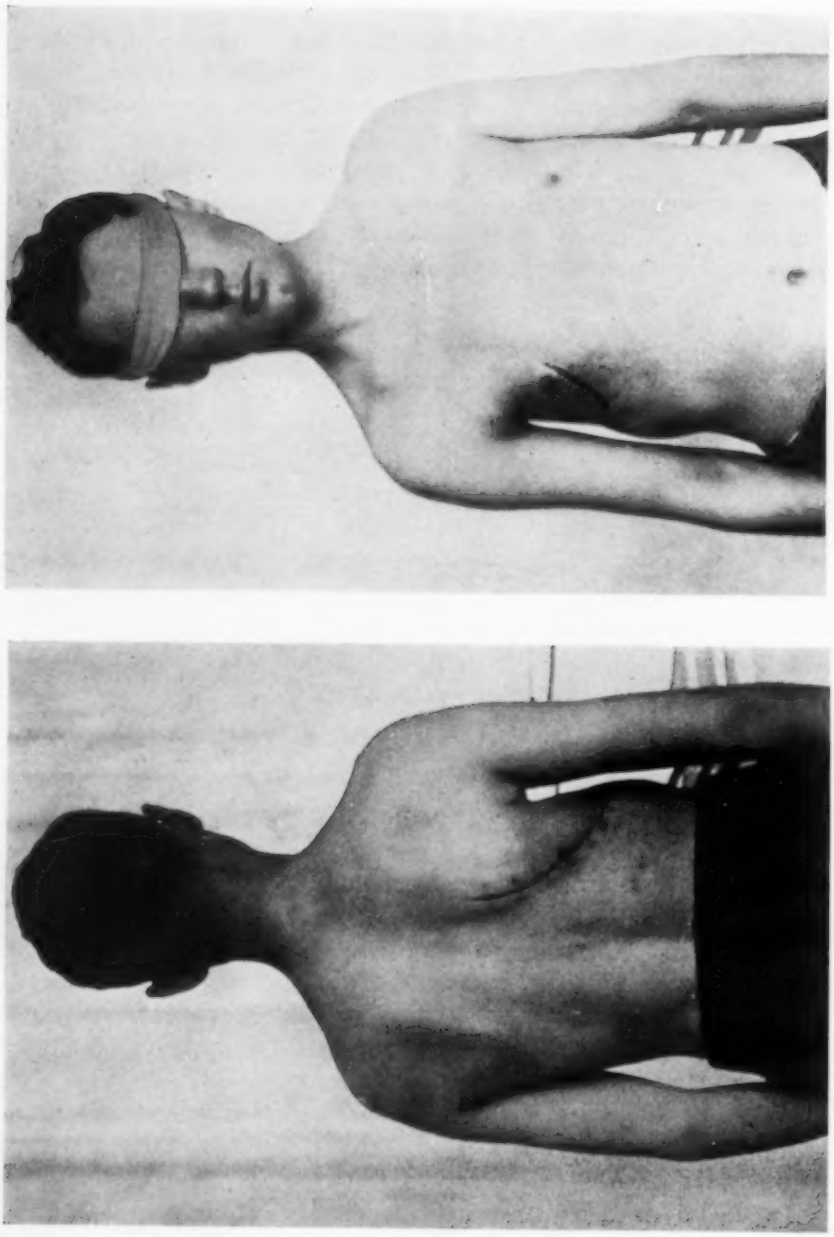


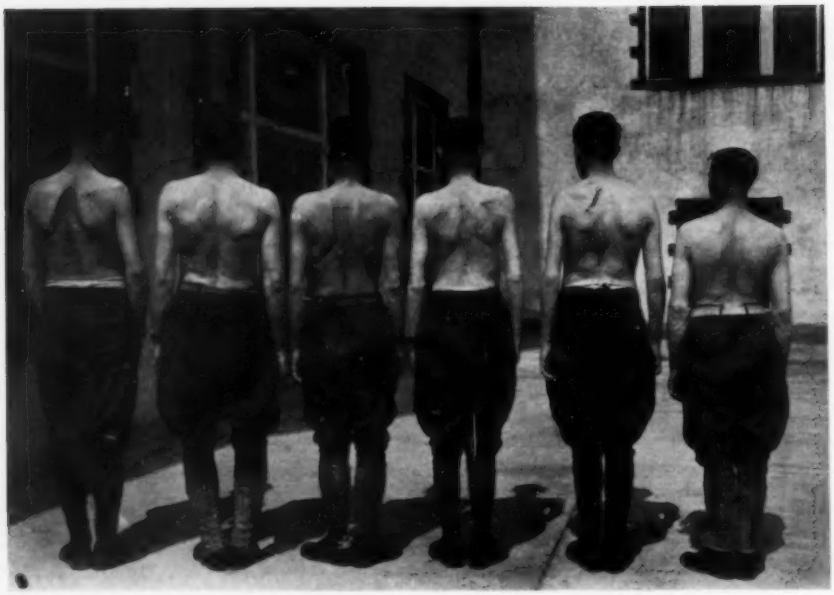
FIG. 8.—Patient H. T. Radical operation, June 11, 1919. Resection of portions of 9th, 8th, 7th, 6th, 5th and 4th ribs. Complete decortication. Wound firmly healed, July 5, 1919.

a bullet, a shell fragment and a piece of uniform. In spite of these findings, however, a radical operation was done because other factors, such as a rigid wall, or recesses, coëxisted and would probably have prevented healing. In some patients only an incomplete decortication was done, owing to their poor condition or to technical difficulties. Sometimes one has to be satisfied with an incomplete operation, a great deal has been gained, and by treating the patient conservatively, healing may be obtained. If necessary one may later re-operate and then find conditions more favorable. It not infrequently becomes necessary to divide the operation into several stages, to avoid the danger of shock. At the first operation one may simply remove the necessary portions of ribs, which in itself is often the most difficult part of the operation on account of fusion of bone and hemorrhage while resecting this bone. At the second operation one may do the complete decortication, or if several recesses are present, one may again subdivide this and do only one recess at a time. If an unusual amount of bleeding is encountered, one may pack the wound, leave the packing in place, and not disturb it until the second operation a week or ten days later. The periods between the different stages of the operation may vary from a week to several months, depending on the condition of the patient. One must not be hurried into an ill-timed operation.

Of the 99 cases here reported, 41 healed in from four to eight weeks; others took longer, and a few had to be subsequently operated on either by myself or someone else. This applies especially to some army cases, which I had to leave soon after I had operated on them. All my patients in civil practice I have been able to follow to a successful result. The two group pictures (Fig. 9 and Fig. 10) represent typical cases of this type.

Of the total number, 67 are known to be healed, 12 are known not to be healed, 1 died, 19 have not been heard from. The latter group are all army cases. For one reason or another it has not been possible to get in touch with these men. It is assumed, however, that the great majority of them are healed, for notes made at the time of operation and soon after, indicate that conditions for healing were favorable. Among these 99 cases there was a mortality of one.

Case Report.—A civilian male patient, fifty-four years old. He had a chronic empyema for two years which had been healed for a while, but re-opened. On account of a mitral regurgitation and a chronic nephritis, he was operated on under local anæsthesia. Portions of 2 ribs were removed, the cavity cleaned out, and Dakin-Carrel treatment then started. Because there was no diminution in the size of the cavity he was re-operated five weeks later. Rectal ether anæsthesia in conjunction with the hypodermic administration of 300 c.c. of a 4 per cent. magn. sulphate solution were given. A portion of an additional rib was resected and decortication attempted, but was unsuccessful because the lung had hepatized and would not expand. The patient never became completely awake. He could be roused, but immediately relapsed into a stuporous state. He died about 24 hours after operation.



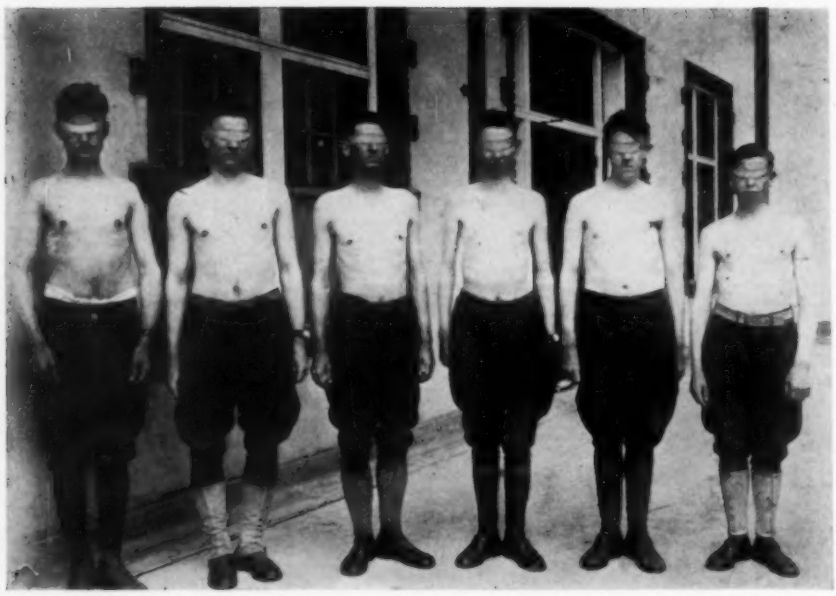
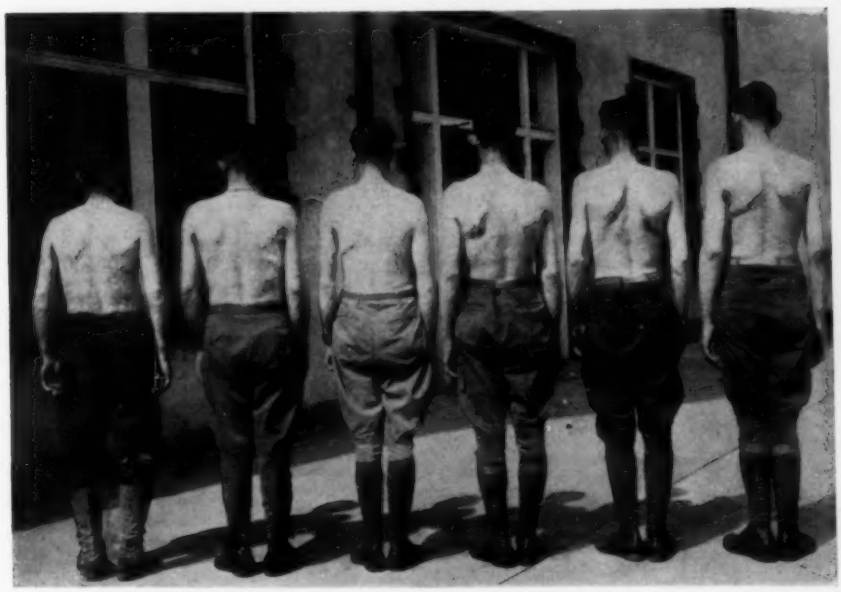


FIG. 9.—1. Pt. C. Radical operation, June 5, 1919. Portions of ribs removed, 7th, 8th, 9th. Healed, July 9, 1919. 2. Pt. P. Radical operation, June 13, 1919. Portions of ribs removed, 7th, 8th, 9th. Healed, July 13, 1919. 3. Pt. P. Radical operation, May 28, 1919. Portions of ribs removed, 6th, 7th, 8th, 9th. Healed, July 21, 1919. 4. Pt. H. Radical operation, June 6, 1919. Portions of ribs removed, 6th, 7th, 8th, 9th. Healed, July 22, 1919. 5. Pt. Mc. C. Radical operation, May 19, 1919. Portions of ribs removed, 4th, 5th, post., 3rd, 4th, ant. Healed, July 14, 1919. 6. Pt. S. Radical operation, May 19, 1919. Portions of ribs removed, 5th, 6th, 7th, 8th. Healed, July 3, 1919.



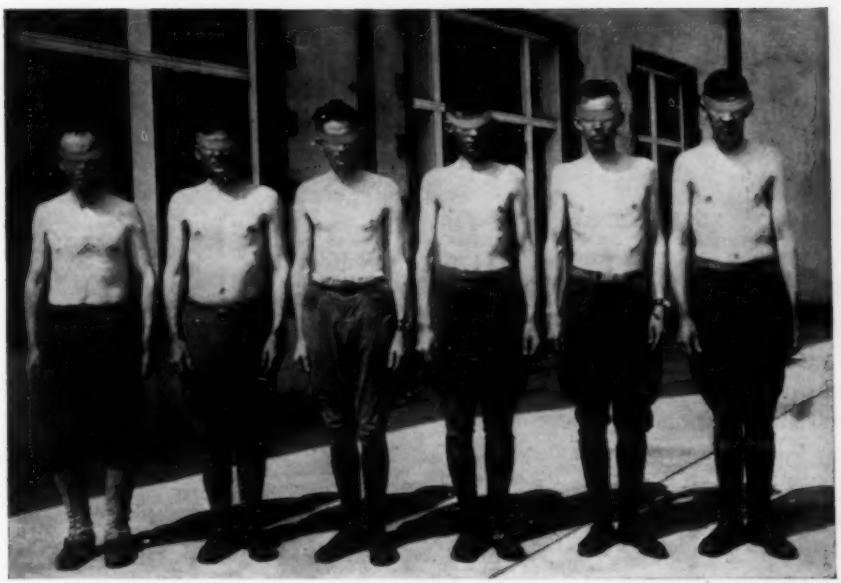


FIG. 10.—1. Pt. J. Radical operation, May 24, 1919. Portions of ribs removed, 7th and 8th. Healed, July 20, 1919. 2. Pt. R. Radical operation, June 9, 1919. Portions of ribs removed, 6th, 7th, 8th, 9th. Healed, July 7, 1919. 3. Pt. S. Radical operation, May 3, 1919. Portions of ribs removed, 9th and 10th. Healed, July 22, 1919. 4. Pt. C. Radical operation, May 24, 1919. Portions of ribs removed, 6th, 7th, 8th, 9th. Healed, July 20, 1919. 5. Pt. P. Radical operation, June 16, 1919. Portions of rib removed, 6th, 7th, 8th. Healed, July 22, 1919. 6. Pt. W. Radical operation, June 6, 1919. Portions of ribs removed, 6th, 7th, 8th, 9th. Healed, July 23, 1919.

The autopsy showed œdema of the lungs, interstitial hemorrhage into the lung, cardiac hypertrophy, cirrhosis of the liver and an acute exacerbation of a chronic nephritis.

The cause of death was given as œdema and interstitial hemorrhages of the lungs following anæsthesia.

We have had the feeling that death in this case was due to the anæsthesia and not the operation.

Group V.—Cases with a chronic open pneumothorax.

The difference between a chronic empyema cavity and a chronic open pneumothorax is that in the former case we are dealing with a cavity overlying a compressed lung, while in the latter we have a cavity overlying a collapsed lung. The two conditions differ in their development and in their pathology. In chronic empyema the lung gradually becomes compressed as the fluid accumulates. Release of this fluid will usually allow the lung to reëxpand. It is for this reason that by far the greater number of all empyema cases recover by simple drainage. Only those cases, in which there is an obstacle to healing, will become chronic and only a small percentage of these will require a radical operation.

In chronic pneumothorax, on the other hand, the entire lung of one side has collapsed. There are two reasons for this: (1) A too early operation before adhesions have formed. (2) Perforation of a lung abscess, producing a pyopneumothorax. Both conditions produce a collapse of the lung toward the mediastinum. If the condition is recognized early, it may be overcome by the use of blow-bottles, arm exercise and deep breathing unless there is a large bronchial communication. Later, however, fibrous changes take place in the lung and no amount of blowing will expand it. These patients have to be subjected to a radical operation. The X-ray with bismuth filling in these cases always shows a long cavity, running from the diaphragm to the apex, as illustrated by Fig. 11.

Because of the changes in the lung itself, the aim of the operation is primarily mobilization or even collapse of the chest wall, and secondarily, mobilization of the lung. In several of our cases we had succeeded in establishing sterility of the cavity, in others it was absolutely impossible. In spite of sterility, however, healing failed to take place. By the time the radical operation is performed nature has done all she can do to obliterate the cavity by drawing in the ribs, pushing up the diaphragm, and pushing or drawing out the lung as far is it will go, or even displacing the mediastinum to the affected side, with compensatory hypertrophy of the opposite lung. The operation should be looked upon as an aid in helping nature complete her task, and it is therefore planned chiefly to produce mobility of the chest wall. In general it follows the principles described under the treatment of chronic empyema. A long skin and muscle incision is made and short pieces of from four to eight ribs are then resected; of the upper ribs only one-half to one inch are often removed, just enough to allow the chest wall to draw inward. That this represents nature's effort is

shown even during the operation, when it can be noted that divided ribs will overlap, or if a short piece is removed, the ends will at once approximate. After removing the outer wall of the cavity, the further course depends on the condition of the patient. Because the resection of the chest wall is usually extensive in these cases, it may be well to interrupt and to divide the operation into two stages. However, if conditions are favorable, one may proceed at once to mobilize the lung and attempt to decorticate. The latter is often very difficult or impossible because fibrous tissue-bands

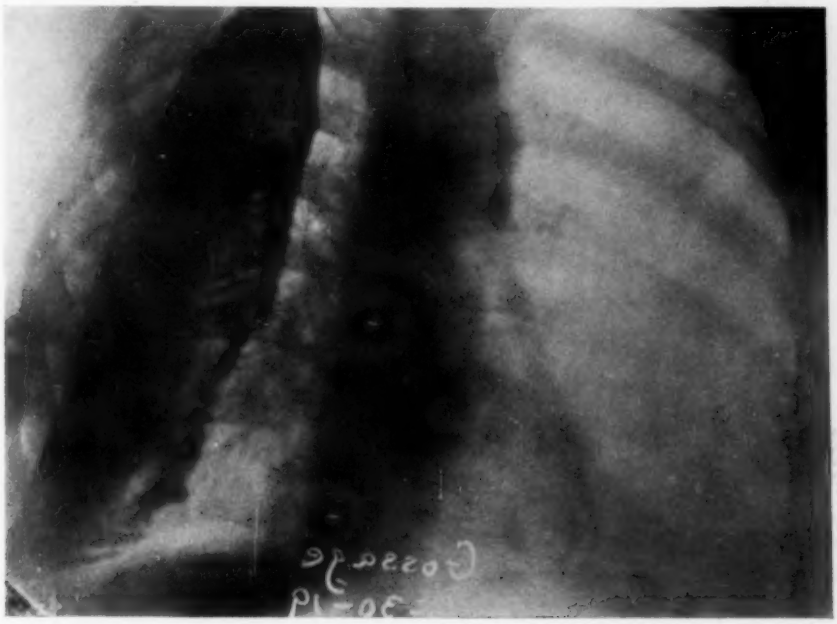


FIG. 11.—Chronic pneumothorax. Filled with bismuth, showing straight vertical cavity extending from the diaphragm to the apex of the thorax.

extend from the pleura into the lung substance. Even if no decortication is possible, the lung should be freed completely around its margin. In this connection I wish to note that in all patients with complete lung collapse on whom I have operated, the lung had not shrivelled up towards the hilus like a sponge, as is believed by many, and as is sometimes graphically illustrated in articles on the subject. It has always been found collapsed towards the entire length of the mediastinum, adherent to the diaphragm below, and to the upper part of the thorax above. In the X-ray the visceral pleura is shown as almost a straight vertical line. Only once have I seen a lung collapsed and shrivelled up towards the hilus, that was in a case with a very extensive exudate, unrecognized for almost two years. After mobilization of the lung, and more or less complete decortication, the further treatment is like that of other chronic empyema cases. The wound is closed by approximating muscles and skin, and instituting drainage at the most dependent part. The use of blow-bottles is started early and is persisted

in. Owing to the extent of the wound, and the fact that decortication may have been incomplete, it usually becomes necessary to maintain drainage for some time and to institute Dakin-Carrel treatment. These pneumothorax cases are among the most rebellious, and constitute a serious problem. It is my belief that patients with a chronic open pneumothorax may be healed by simple drainage assisted by exercise and the use of blow-bottles, if recognized early. Once well established, I believe these patients should be subjected to a radical operation early, at a time when something may still be expected from reëxpansion of the lung, before fibrous changes have taken place.

FIG. 12.—Chronic empyema of twelve years duration showing small recess at anterior extremity of costophrenic sinus, filled with bismuth. Picture also shows nature's effort to obliterate cavity by overlapping of ribs like shingles on a roof.

We have treated fifteen cases of this type, and have succeeded in healing seven. Patient M., Fig. 13, represents a typical case, with the resection of parts of seven ribs. Four patients are known not to be healed, and one we have not heard from. Of this small group of fifteen cases three died, and although we found an acute dilatation of the stomach in one case, which may have contributed to his death, and we were dealing with a known tertiary syphilitic in another, I believe the actual cause of death in all three was shock. These patients were bad risks, but because they showed no tendency to get well, the operation was indicated. A less radical procedure at the time, doing only a partial operation, might have saved them. Short reports of these three cases follow.

Case Reports.—Patient H. G. Complete pneumothorax right, existing 8½ months. Had been on anti-syphilitic treatment. June 28, 1919, operation, resection of part of seven ribs with mobilization of lung. June 30, 1919, post-operative reaction good. Suddenly woke up out of a sound sleep, expressed fear, and went into a convulsive seizure resembling epilepsy. Exitus in about 10 minutes.

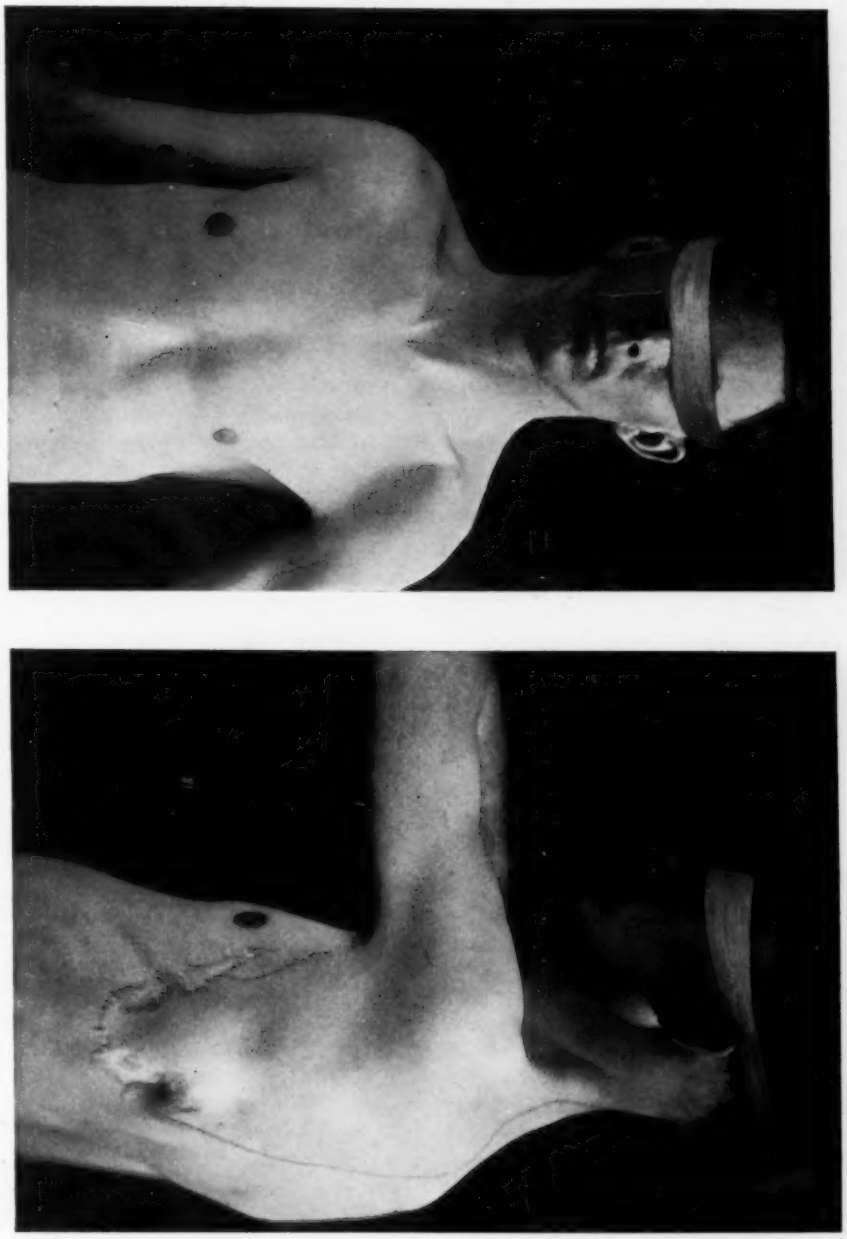


FIG. 13.—Typical chronic pneumothorax healed after radical operation. Portions of seven ribs were resected and a complete decortication was done.

Autopsy showed cerebral œdema, syphilitic aortitis with calcareous deposits and beginning thrombus formation.

Patient W. B. Complete pneumothorax of two years duration. Has had many operations without improvement. August 9, 1919, operation, resection of portions of seven ribs. No mobilization of lung attempted on account of poor condition. Death after 28 hours from shock. Examination of the affected lung showed that it still contained some air, but that bands of fibrous tissue extended from the pleura into the depth and prevented expansion.

Patient C. B. Pneumothorax for 15 months. Had been operated on five times. Had three openings into the chest, one anteriorly, and two posteriorly. Bronchial communication present. August 25, 1919, resection of pieces of 8 ribs, which was very difficult on account of extensive fusion. Lung mobilized but not decorticated.

Next morning he looked very hopeful, but while turning onto his side he died suddenly. Autopsy showed an acute dilatation of the stomach containing 1300 c.c. greenish fluid.

Group VI.—Cases with bronchial or pulmonary communication.

In an article on the treatment of bronchial fistulæ,‡ I have described the different varieties of bronchial fistulæ and divided them into broncho-pleural and broncho-cutaneous. The latter have to be closed by surgical means, while the former usually close spontaneously as healing of the cavity progresses. A certain number of these, however, are responsible for the persistence of a chronic empyema cavity, and have to be treated. It has been found that all patients in whom a broncho-pleural or pulmonary-pleural communication was diagnosed, either clinically or by actual observation during a radical operation, would heal after such an operation. It seems well established therefore that the mobilization and decortication of the lung removes the mechanical factors preventing closure of the fistula. For this reason all these cases are included in the group of chronic empyema described above.

The six broncho-cutaneous fistulæ encountered have been described in detail in the paper mentioned above. They are all healed. There was a seventh case, which ended fatally, the record of which follows:

Case Report.—Patient L. M. had influenza in October, 1918, followed by empyema. Two operations had been done, resection of the 6th rib anteriorly and the 9th rib posteriorly. Both openings communicated with bronchi and both discharged pus in large amount. The patient had been kept under treatment with the intention to improve his general condition, but without result. He was a physical wreck.

June 16, 1919, operation was undertaken to establish better drainage. A complete pyopneumothorax was found, divided into several compartments. In order to drain them all, portions of six ribs were removed. Both fistulæ were found to enter the lower lobe. Nothing was done but to establish drainage.

The patient died the same day of shock. The autopsy showed a complete pyopneumothorax, and a partially necrotic left lower lobe, containing an abscess the size of a hen's egg. Three fistulæ led from this abscess to the surface of the lung.

‡ The Treatment of Bronchial Fistulæ, Carl Eggers, ANNALS OF SURGERY, September, 1920.

Group VII.—Cases with tuberculosis.

Among any larger group of patients with chronic empyema one may encounter several with tuberculosis of the lung, the pleura, or both. If, in spite of the establishment of good drainage, thereby cutting down the absorption of septic material to a minimum, and after other complications have been ruled out, chronic empyema patients continue anæmic and underweight for any considerable period, tuberculosis has to be considered. But even though suspected, many months often elapse before the true nature of the disease is recognized or proven by laboratory tests. Owing to a thickened pleura and other intrathoracic changes the X-ray frequently fails, and one has to rely on sputum examinations or bacteriological examinations of the discharge from the sinus. Occasionally an excised piece of tissue from the wall of the sinus establishes the diagnosis. Owing to these diagnostic difficulties patients with tuberculosis are sometimes subjected to radical operation before the true nature is recognized. We have seen such an operation lead to cure of the empyma while the intrapulmonary disease continued. In other cases, healing failed to take place. Among the series here reported there were eleven cases in which positive evidence of tuberculosis was obtained after radical operation. Of these 11 cases, 3 are healed, 1 healed and died one year later, 1 is not healed, 3 did not heal and later died, 3 have not been heard from. Because they were not recognized before operation, these patients are included in the group of 99 chronic cases described above.

I wish to call special attention to patients who were known to be tuberculous and in whom operation was deliberately undertaken with a view to curing them in this manner. I have had six such cases in the last few years. Three of these have healed and are apparently also cured of their intrapulmonary focus. One is at present under treatment, one is in a government sanitarium, and one has not been heard from. This subject will be reported on in more detail at a later time.

CONTRAINDICATIONS TO OPERATION

As long as there is a reasonable chance that patients may be cured by more conservative means, radical operation should not be attempted.

A septic state, as evidenced by anæmia and underweight, lack of tone, and a rapid heart, is a contraindication. In such patients the general condition must first be improved by adequate drainage, sterilization of the cavity, and attention to exercise and hygiene.

Complications in other organs, as endocarditis, myocarditis or nephritis, may contraindicate a radical intervention. One must judge each case carefully.

In the presence of active pulmonary tuberculosis one should certainly not attempt any extensive operation, but by choosing an anæsthetic carefully,

or even operating under local anæsthesia, good results may be obtained as soon as the intrapulmonary focus has quieted down.

DANGERS AND COMPLICATIONS

Shock is a condition brought about by carrying the operation beyond the threshold of safety, or to hemorrhage, or both. If the patient has been carefully studied, and the operation planned in advance, one can work expeditiously and not lose time deliberating during the operation. One should never attempt more than the patient can stand. Therefore one should interrupt the operation at any time when it is realized that carrying it to completion would involve grave risk, and continue it at another time. Operations on the left side have always impressed me as being more dangerous than those on the right.

Hemorrhage must be guarded against, both at the time of and after operation. It is the chief factor in producing shock. Considerable bleeding is often encountered during rib resections, especially in old cases with reformed bone. Intercostal vessels must be carefully ligated. The best method is to use catgut on a strong, curved needle and to ligate the vessels with some muscle tissue a short distance behind the bony ends. We have had rather excessive post-operative oozing in a few cases, necessitating opening of the wound and packing it. In two patients there was severe hemorrhage, which became alarming in one. Both reacted to proper treatment.

In a few of our cases the diaphragm was accidentally entered, because it was difficult to differentiate between it and inflammatory tissue. As soon as the condition was recognized the damage was repaired by interrupted chromic-gut sutures, and in no case has it led to trouble later on.

While doing decortications the lung parenchyma was damaged in several cases, causing bleeding and escape of air. This usually happened in those patients in whom it was difficult to separate the inflammatory layer from the visceral pleura. No permanent lung injury has resulted from that in any case. Bleeding was usually controlled by hot packs, in other cases by fine catgut sutures. No lung fistula resulted in any case, because the damage was always superficial in character.

Subcutaneous emphysema was encountered in only two cases, and in neither did it assume alarming proportions.

Although one might expect pneumonia to develop in some of these patients, due to handling of the lung, we had to deal with this complication in but two cases, in one on the operated side, in the other on the opposite side. Both patients recovered.

In one case we had a paralysis of the arm on the normal side, probably due to pressure on the brachial plexus. This happened in spite of the fact that in all patients precautions were taken to avoid such an accident. The

position as shown in Fig. 3, with the lower arm placed over the head, effectually prevents pressure on the plexus.

DEFORMITIES

When the subject of extensive rib resections is mentioned, one is apt to have visions of terrible deformities with extensive collapse of the chest wall, such as have been published in old text-books. There is no doubt that in some cases this is unavoidable, but in the great majority of the cases here reported the resulting deformity is slight. There are a number of reasons for this.

1. The portions of rib excised are usually short, from two to four inches long, and still shorter in the upper thorax. Even if longer, very little deformity usually results except in those patients in whom parts of the lower thorax are removed, allowing the diaphragm to draw the entire lower chest inward.

2. A complete muscle suture of all the layers, followed by a skin suture, does much to prevent deformity.

3. Reliance is placed not on collapse or mobilization of the chest wall, but rather on the reëxpansion of the lung. It is for this reason that so much care is taken to remove all of the empyema wall.

4. Patients are not allowed to remain long in bed in a cramped position. They get out on the third to the seventh day and are encouraged to breathe deeply and use blow-bottles early. They are instructed to stand in front of a mirror to see that their shoulders are of equal height, to draw them back and then breathe deeply.

5. Nearly all the patients are adults, and their bony framework is rather firm. They have been accustomed to carry themselves erect, and if they are allowed or encouraged to use their muscles early, they will maintain themselves in good position.

6. This erect position is later partly maintained by bony bridges which form from one rib to another, at their spinal ends, and practically splint the chest, keeping the ribs separated and preventing a complete collapse and curvature of the spine. These bony bridges can be seen by means of the X-ray as early as six weeks after operation. Later they become very firm and give strong support (Fig. 14). All deformities should not be attributed to the radical operation, for it must be borne in mind that many chronic empyema patients have deformities, from long-continued drainage and improper carriage, before they are subjected to radical operation. They have flattening of the chest on the affected side, with immobility, and frequently curvature of the spine and elevation of the shoulder. A radical operation often decidedly improves such deformities, because it does away with the fixation of the chest, and allows patients to straighten up and breathe deeply.

RESULTS

Among 146 patients with chronic empyema subjected to radical operation of the nature described in this paper there was an operative mortality of five, or 3.4 per cent. There are six other deaths to be reported which occurred a year or more after the operation. Four of these were in patients with tuberculosis, the same ones reported under that sub-heading, one in an unhealed patient who still had four machine-gun bullets in different parts of his chest at the time of death, and one in a healed patient who contracted pneumonia of the opposite lung one year after healing. None of these deaths are directly traceable to the operation.

FIG. 14.—X-ray shows bony bridges which have developed between the ends of adjoining resected ribs. They prevent collapse and splint the chest wall.

This method of operating can be advocated because it gives excellent access, it removes all infected tissue, thereby preventing recurrence, and it minimizes deformity.

That the muscle power is good, even after very extensive operations, is due to the fact that the muscles are immediately sutured and that patients are encouraged to use them early.

Figures 15, 16 and 17 illustrate what patients are able to do.

Their general well-being is materially improved, and though some patients continue to complain of pain in the chest and dyspnœa on exertion, the great majority state that they feel better, that their lungs expand, and that they are less dyspnœic. They can breathe deeply because the fixation of the thorax and lung have been removed.

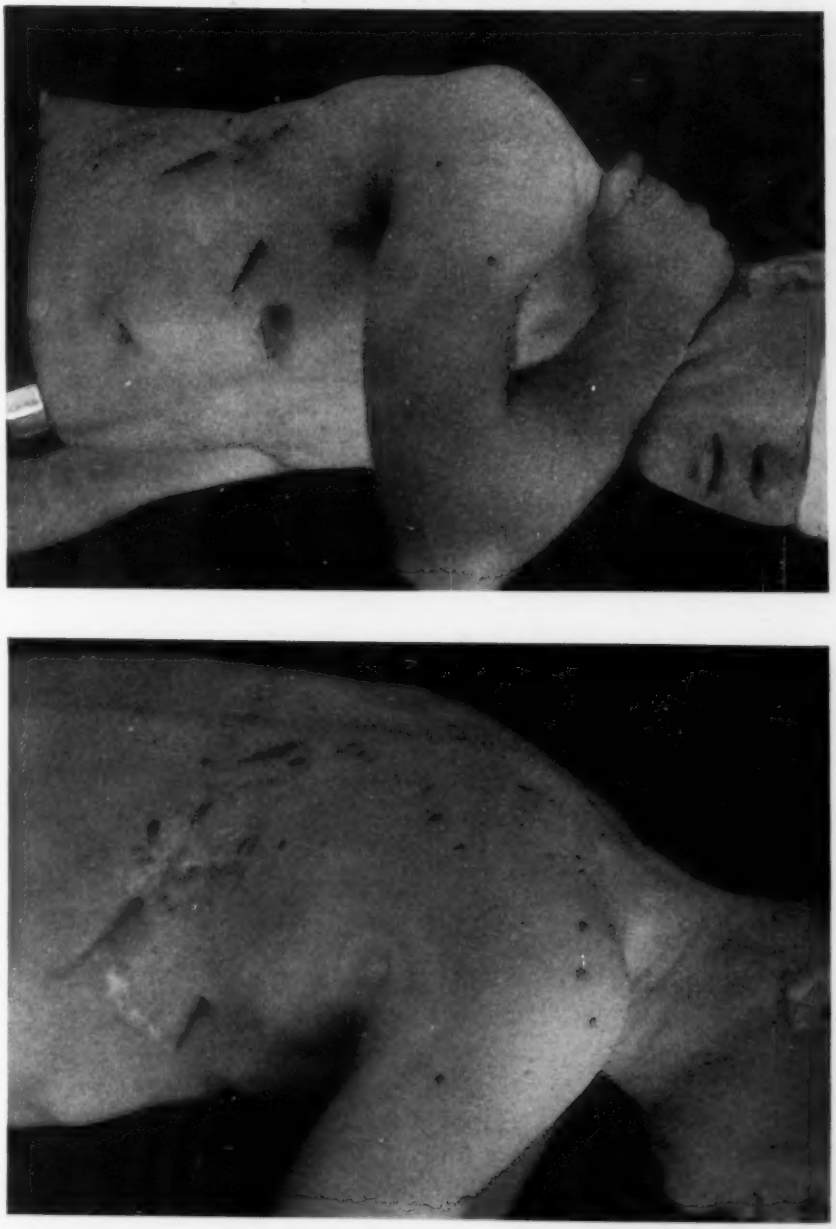


FIG. 15.—Patient A. B. Final result after radical operation in a patient who had empyema for twelve years.

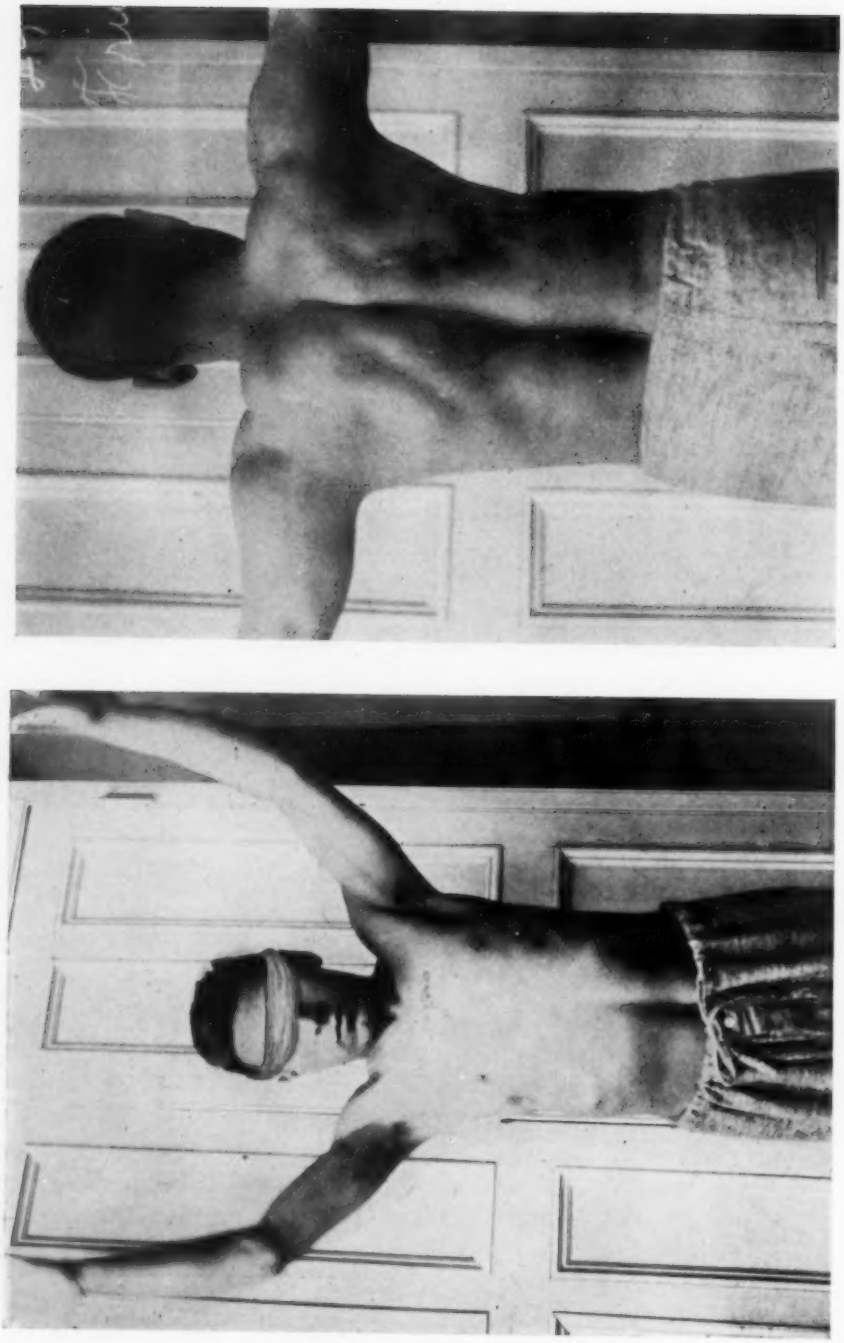


FIG. 16.—Patient A. F. Showing good functional result after a typical radical operation with decortication of the lung.

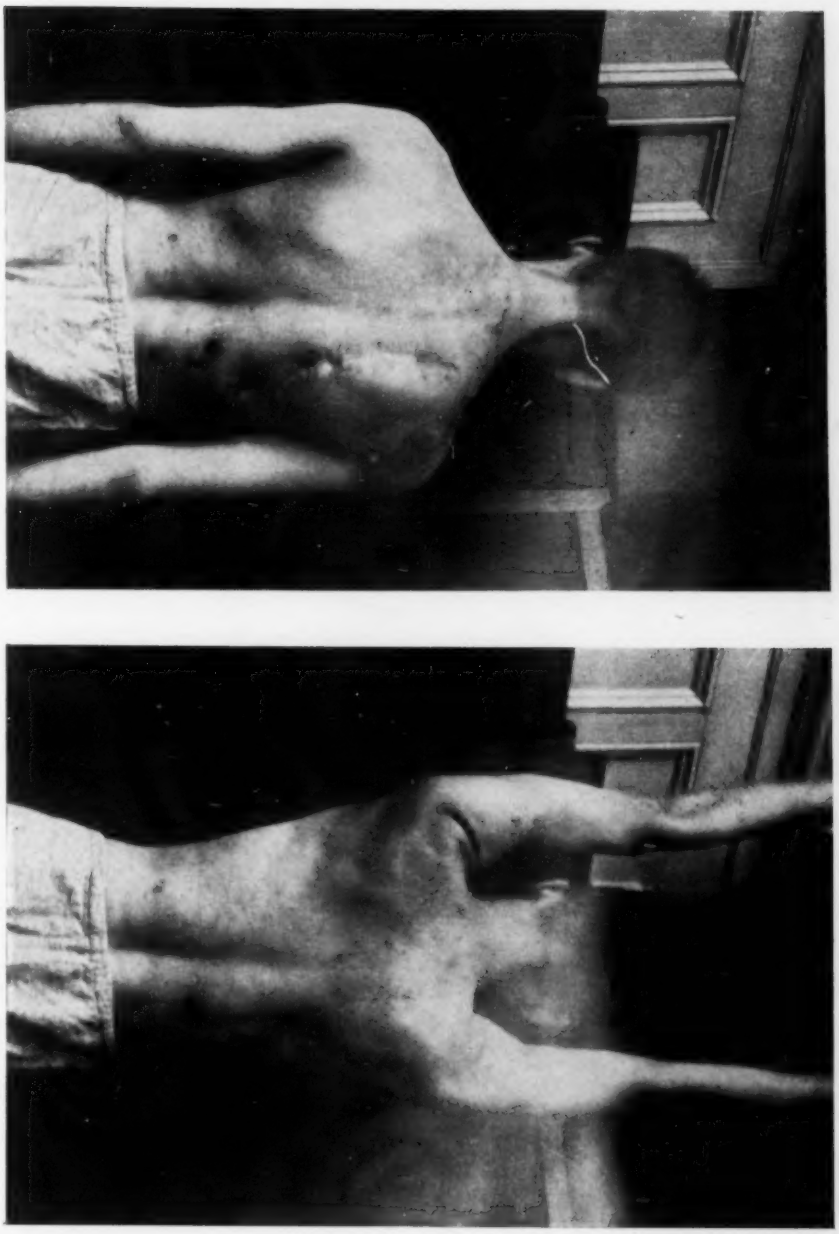


FIG. 17.—Patient R. E. Showing final result after several radical operations had been done with resection of portions of six ribs.

TERATOID MIXED TUMORS OF THE BREAST*

REPORT OF A CASE

By Monroe Anderson McIver, M.D.

of Boston, Mass.

RESIDENT SURGEON, MASSACHUSETTS GENERAL HOSPITAL

Tumors of the breast containing bone and cartilage have long been recognized and have always excited considerable interest. Velpeau [1] refers to cases described by Morgagni, Wolf and Bonnet; but the first case to attract widespread attention was one reported at length by Sir Astley Cooper [2] in 1829. This case has become traditional in the literature, and references to it may be found in practically every standard treatise on tumors of the breast from the time of Nelaton [3] to the present. Deaver and McFarland [4] in 1917 were able to collect about two dozen cases of mammary tumors showing cartilage and sometimes bone as important constituents.

Fig. 1.—Gross appearance of the portion of the tumor showing teeth and alveolar process.

In attempting to classify the case of mixed tumor of the breast presented in this report, the terminology employed by Ewing [5] in his recent monograph on neoplastic diseases has been adopted. The term teratoma as applied to tumors of the breast has found its way into the literature to only a very slight extent. No case was found in the *Index Medicus* reported under that title, although the conception that these neoplasms arise from embryonal rests is not new. Wilms,[6] in 1902, in his classical monograph discusses mixed tumors of the breast, and concludes that their derivation is to be referred to the earliest period of differentiation of the three germ layers; and more recently this view has been strongly championed by various French writers, notably Nadal [7] and Menetrier.[8]

* From the service of Dr. Franklin G. Balch.

The tissues of the breast are capable of undergoing extensive metaplastic changes and, according to Cornil and Petit[9] these mixed tumors are considered to arise locally by a process of metaplasia.

Since such different types of neoplasms, varying from the most complex mixed tumors containing bone, cartilage, and squamous epithelium, to the very simple types in which one kind of tissue predominates, as in the osteomas and chondromas, may be considered as belonging to this group of teratoid mixed tumors, it is not remarkable that there is difference of opinion as to their etiology.

This case is reported with the view of putting this rather unusual neoplasm on record, and in the hope that it may possibly throw some light on the origin of these mixed tumors. No case was found in the literature on neoplasms of the breast in which teeth were noted.

According to Ewing[10] these tumors are slow growing and comparatively harmless, yet carcinomatous and sarcomatous metastases are sometimes observed reproducing the original structure.

The patient whose case is presented in this report entered the Massachusetts General Hospital February 3, 1922.†

FIG. 2.—Low power appearance of the trabeculæ of osteoid tissue scattered through the tumor.

Case Report.—G. E. H., Hospital No. 247784. An American housewife, sixty years of age. General health has always been good. For the past several years she has suffered from slight dyspnœa on exertion, and she has noticed some swelling of her ankles. Three months ago the patient first noticed a lump the size of a walnut in the right breast. She consulted her family physician at once, who advised operation, but she refused. Since that time she thinks that the mass has increased in size, and she is conscious of an almost constant dull, aching pain, localized just over the tumor. Her general health she considers to be good. No loss of weight; present weight 240 pounds.

A very obese woman. The general physical examination is otherwise negative,

† For permission to publish this case, I am indebted to the operating surgeon, Dr. Beth Vincent.

except for persistent moist râles at the bases of both lungs, and rather marked varicosities of the veins of both legs. Blood-pressure 160/100.

Breasts.—In the upper outer quadrant of the right breast, a hard, firm mass, about the size of a small orange, can be palpated. The tumor appears to be situated rather deeply in the substance of the breast. The skin is not firmly adherent, but there appears to be some attachment to the underlying mass. No retraction of the nipple is noted. No enlarged glands can be palpated in the axilla, but the examination is rather unsatisfactory because of the obesity of the patient. The left breast appears to be normal.

Diagnosis.—A diagnosis of carcinoma of the breast was made, although it was realized that certain aspects of the case were not altogether typical, notably the relatively small amount of attachment to the skin in comparison to the size of the tumor.

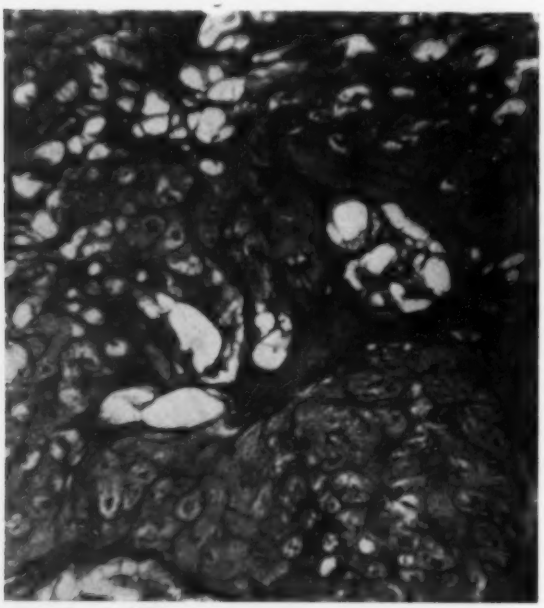


FIG. 3.—An area of cartilage.

Operation. — Because of the obesity of the patient and the pathology noted in the lung, the operation was carried out under local anæsthesia. The axilla was dissected and the entire breast removed. On section of the breast, a hard bony tumor was found, measuring about 10 cm. in diameter. In the centre of this tumor an alveolar process with teeth was discovered. The gross appearance of this unusual specimen is shown in Fig. 1. The microscopic appearance of the bony and cartilaginous areas scattered through the tumor will be seen in Figs. 2 and 3.

Post-operative History.—The wound showed evidence of infection within forty-eight hours, necessitating the removal of a few stitches and the establishment of drainage. Because of the excessive amount of fat tissue this local sepsis proved rather slow in clearing up, and although the patient's general condition was considered to be satisfactory, she was still receiving daily dressings and showed some evening elevation of temperature when she died suddenly thirteen days after operation with symptoms suggesting pulmonary embolism. No autopsy could be obtained.

Pathological Report by H. C. Hartwell, Pathologist:

"Specimen, breast with axillary contents attached. The breast on section shows a hard spherical tumor in its outer hemisphere, surrounded by the fat of the breast. The tumor is about 10 cm. in diameter and has a fibrous, grayish-

white surface, a large portion of which is of bony hardness. In one area an alveolar process with teeth can be made out. The surrounding breast itself is fibrous with cysts. There are a few soft lymph-nodes in the axillary contents.

"Microscopic examination shows a nondescript connective tissue which in places is cell-rich and shows numerous mitotic figures. There are trabeculæ of osteoid tissue scattered through it and an occasional area of cartilage. There is no evidence that the tumor is malignant. The axillary lymph-nodes are normal.

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RUPTURE OF THE LONG HEAD OF THE BICEPS FLEXOR CUBITI MUSCLE

By Nelson Amos Ludington, M.D.
of New Haven, Conn.

It is desired to stimulate interest in this lesion in the belief that it is both more common than is generally supposed and more readily amenable to surgical treatment than the brief and discouraging text of standard treaties indicates; to present a new diagnostic test for its recognition, and to distinguish between those cases in which the lesion is due to trauma and those in which it is due to disease.

Case.—J. H. Millwright, fifty-six years old. Fourteen weeks ago was lifting one end of a box (weight, 312½ pounds) from the floor onto the rear end of a truck when he experienced a "sudden sharp pain like a knife" in the right upper arm and shoulder. His arm fell to his side and he dropped his end of the box. The pain was of brief duration and he continued at work using his left hand only. In a few hours the pain gradually returned, increased in severity, and lasted two weeks, during which time he carried his arm in a sling.

He was unable to resume his work on account of soreness in the shoulder and a loss of power in flexing the right forearm beyond a right angle. He has difficulty in abduction, and the weakness, both in flexion and abduction, has been progressive, and has not been benefited by treatment. He has never noted swelling, discoloration, or deformity in the arm or shoulder.

Past History.—Lumbago seventeen years ago. Alleged gall-stone attack nine years ago. No muscle or joint pains. No previous trauma. Alcohol and tobacco in moderation.

Examination.—Powerful muscular type. The general physical examination is entirely negative. In the right shoulder joint there is a distinctly palpable and faintly audible "creak," a point of tenderness just under the tip of the acromion, and a limitation of voluntary abduction, circumduction, and backward extension. There is slight atrophy in the upper arm and efforts at abduction reveal a slight hollow on the anterior surface of the arm immediately below and parallel to the anterior edge of the deltoid. Huters-sign is absent. The belly of the biceps when contracted is soft. The tendon of the long head could not be palpated. The arms being symmetrically abducted with the forearms fully flexed, it is noted that the biceps bulge on the affected side is further away from the deltoid and more abrupt in its rise than that on the sound side.

It is desired at this point to call attention to the following diagnostic test, which was positive in this case, and which the writer believes has not previously been recorded.

The patient was directed to rest his folded hands, palms down, on the top of his head and allow the interlocked fingers to support the weight of the arms. In this position there is maximum relaxation of the long head. The examiner then places two fingers on the tendon of the long head of the biceps in each arm as is shown in figure one, and directs the patient to simultaneously contract and relax his biceps muscles. The contraction of the long head tendon on the sound side is plainly felt while it is absent on the affected side if the tendon is ruptured.

Influenced very considerably by the results of this test, operation was done eighty-five days after injury. The tendon presented normally but under less than the usual tension when lifted from its bed. It was followed up through a normal bicipital groove and found to be torn about four-fifths across at its origin. The remaining fifth was divided with scissors. Owing to adhesions about 2 cm. below the groove a portion of the sheath was removed with the tendon which was amputated close to the fleshy portion of the long head. A slit about four cm. long was made in the short head. Into this slit the stump of the long head was sutured, under slight tension, with No. 2, chromic gut, the forearm being held in right-angled flexion. The wound was closed without drainage.

The after treatment consisted of immobilization in right-angled flexion for fourteen days; massage and passive motion until the twenty-eighth day, when all dressings were removed and active motion encouraged.

Ten weeks after operation he was able to work half a day at manual labor, and at the end of fourteen weeks he had resumed his previous occupation, working full time and without disability.

I am indebted to Doctor Moies of the Brady Laboratory for Pathology associated with the Medical Department of Yale University for the following report of the results of a careful study of the specimen submitted.

"Pathological Report, M220-21. The specimen is the long head of the biceps muscle. One end is ruptured and the edge is somewhat fringed out. There is a small hard nodule just above the middle portion. Microscopically: sections were made from the upper portion, through the hard nodule and through the distal end. In the proximal end the blood-vessel walls appear somewhat thickened. The hard nodule shows a very dense hyaline-like tissue. The section from the distal end shows no marked abnormality. Diagnosis: ruptured biceps tendon." (Fig. 2.)

We may classify these cases in two ways, according to their etiology and according to the pathological findings. Etiologically, they are either spontaneous or traumatic. Pathologically the site of rupture is either in the bicipital groove or outside the groove. Those cases in which the rupture is in the groove are spontaneous, and those in which the site of rupture is without the groove have a history of trauma.

The antecedent pathology of rupture in the groove has been clearly set forth by Borchers,[1] while that of rupture outside the groove is as yet a debatable subject, not only as to its character but as to its existence as well.

Davis says,[2] "The tensile strength of healthy tendon is so great that it is my belief that true rupture is much rarer than is usually supposed, and that when a tendon does rupture it is very likely to have been diseased." Keen [3] agrees with this view. Keen, Davis, Bryant (quoted by Davis), and Alexander [4] all associated this lesion with arthritis deformans in a general way.

Borchers, however, goes into details. He gives the credit for demonstrating the causative relation of arthritis deformans, to Ledderhouse, who made a number of dissections and found that in cadavers of moderately advanced age, 50 per cent. showed some lesion about the shoulder joint, characteristic of arthritis deformans. The same was true of ten out of fifteen older bodies. Ewald, stimulated by Ledderhouse's findings, pursued the subject both along clinical and radiologic lines and corroborates Ledderhouse. Both agree that the exostoses of arthritis deformans first and more promi-

nently appear about the shoulder joint in the region of the tuberosities and along the bicipital groove. Radiograms, however, failed to show characteristic change in many cases in which the clinical evidence was unmistakable.

Borchers' exposition of the sequence of pathological events leading up to spontaneous rupture of the tendon is briefly, in substance as follows:[6]

Osteophitic outgrowths appear on the tuberosities of the humerus and grow towards each other, thus tending to convert the groove into a canal. The same process takes place in the floor of the groove and along the bicipital

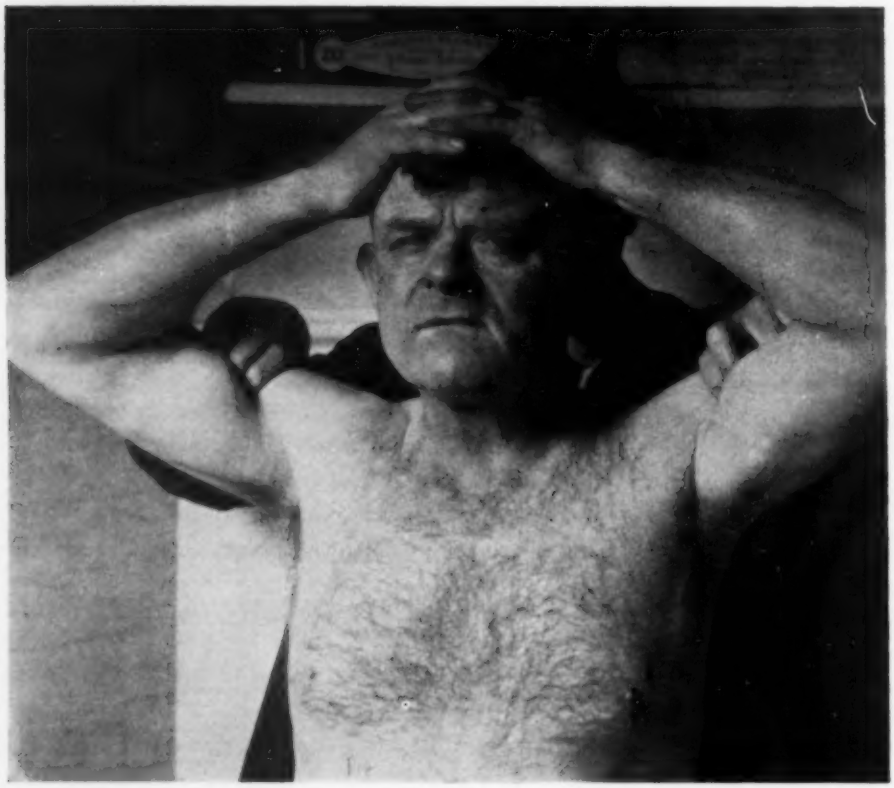

FIG. 1.—Showing position of arms and examiners fingers in testing for ruptured long head triceps tendon.

ridges. These outgrowths are at first smooth, rounded excrescences; later they add a sharply pointed top or spicule.

Three possibilities at once become apparent:

1. If the growth from the summits of the ridges is the more rapid, the groove may be covered over, converted into a canal, and the tendon imprisoned therein.

2. If the growth from the floor of the groove is the more rapid it may fill the groove and mechanically dislodge the tendon from its bed.

3. In either event the early formation of spicules may cause the tendon to chafe itself through incident to its back-and-forth motion in the groove.

Gurlt (quoted by Ewald) found one case of dislodged tendon and one case of imprisoned tendon. Similar instances are referred to by Cruveilhier. This seems to account for spontaneous rupture in the groove very clearly, but leaves ruptures outside the groove unexplained but for a tentative hypothesis of "obliterating endarteritis" put forward by this same author.

In the cases classed from their history as traumatic, the rupture has always been found outside the groove and most usually above the groove adjacent to, or at, the origin of the tendon. Two cases were found in which the rupture was below the groove. In one the patient grasped a rapidly revolving fly-wheel, with the resultant rupture at the junction of the tendon and belly of the long head. It is fair, in this instance, to assume that the maximum tension came on the long head with the forearm quite extended and the humerus so drawn away from the body as to permit the long head to pass from its insertion to its origin in a straight line, instead of lying on and following the curve of the humeral head, as would usually be the case in lifting. The rupture therefore occurred at the recognized weak point of the flexor mechanism, *i.e.*, the junction of tendon and muscle belly, because the mechanical conditions were such as to equalize the distribution of strain. In the second case of rupture below the groove there was a history of repeated direct trauma to the tendon at the site of its rupture and at operation "a fusiform ecchymotic swelling was found" [5] which undoubtedly diminished its tensile strength.

Cases of a direct solution of continuity of tissue from a direct trauma, such as a sabre cut, are intentionally omitted, as they have no bearing on the question under discussion.

The literature affords meagre data on the pathology of tendons. The operative findings in these cases have been varied, as follows:

A fusiform hemorrhagic swelling and adhesions to the sheath.

No tendon at all as far up as the groove (operation seven weeks after injury).

An inch and a half of cicatricial fibrous tissue. Four years after injury.

A small fibrous cord. Six months after injury.

No pathological study of these tendons is recorded. In the study of the tendon submitted to Doctor Moies there is no definite reason shown for its rupture. The origin of the adhesions and the dense hyaline mass is also unknown. Either or both of these abnormalities may have antedated the rupture or may have developed subsequently thereto. The arterial thickening in the proximal end of the tendon was negligible in its extent.

In the absence of definitely recognizable lesion in the tendon we may with propriety consider the possibility of mechanical rupture of the tendon above the groove.

It is usual to think of the stress in the flexor mechanism of the arm as beginning at the shoulder and expending itself at the elbow. But action and reaction are equal. Therefore let us consider the weight to be lifted as the power, applied at the elbow; the body bent forward and the humerus drawn well away from the side. Under these circumstances the long head tendon

is free of the humeral head and the tubercles of the humerus most nearly approach the glenoid rim. As the body straightens up the humerus swings down toward the side of the body, the tuberosities draw away from the glenoid and the tendon of the long head is deflected from a straight line and forced to lie on and be forced upward by the rounded humeral head.

The humerus becomes in effect a lever of the second class, the long arm of which is its longitudinal axis, with the weight being lifted acting as the power. The fulcrum is the point of contact of humeral head and glenoid. The short arm is the line from the fulcrum to the intertubercular humeral notch. The mechanical advantage of this leverage is about fifteen to one.

Omitting any discussion of the many mechanical factors which were worked out in studying this proposition, the conclusion reached is that the

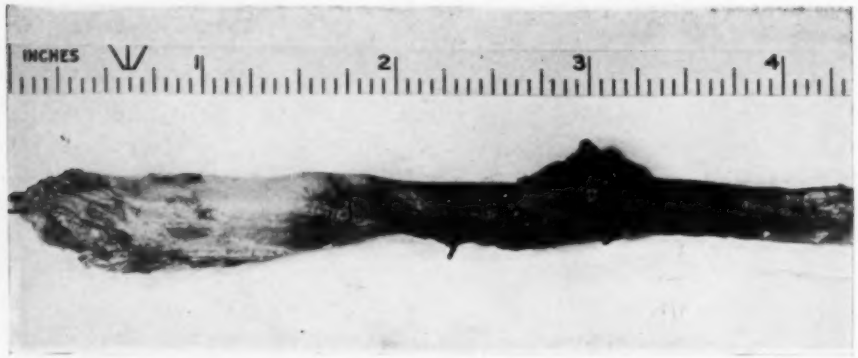

FIG. 2.—The removed tendon. Note hyaline mass under 1¾-inch mark. Frayed-out end with hook in portion cut by scissors. Adherent sheath at 3-inch mark.

practical result of this leverage is a material increase in the strain on the tendon above the groove, the strain below the groove remaining constant.

As this is entirely in harmony with the operative findings it is reasonable to consider that rupture above the groove may be attributed to muscular effort alone. If there be present in the tendon or its sheath any condition which would impede the free passage of the tendon through the intertubercular notch, that condition would be favorable to rupture, and should be accorded recognition as a predisposing factor.

Keen (*loc. cit.*) reports a case in which the tendon was found intact but the periosteum and a portion of the margin of the glenoid was torn off. This is in fact a case of fracture of the scapula by muscular action. There is no longer any claim that such a condition involves previous disease of the bone. The claim of previous pathology when the rupture takes place at the origin would seem in this connection to be an attempt to explain a difficulty which does not exist.

If further observation shall support the foregoing, and two sites of rupture shall come to be recognized as having distinct etiological and pathological bases, then the clinical recognition of the site of rupture will have in

addition to its academic interest the further value of aiding in establishing the rights of the parties at interest in those cases which come within the domain of the Workmen's Compensation Laws.

Unfortunately a careful study of the situation makes it seem certain that any opinion as to the site of rupture based on clinical and radiologic findings is at best very unreliable. The history as it pertains to the character and degree of force being exerted at the moment of rupture is indicative only of the class to which the case may belong. The pain at the time of rupture is by its intensity also indicative only. Aside from these two indications all other symptoms are common to both classes, and it is certain that the site of rupture may be definitely stated only after it has been determined by operative procedure.

Regardless of the site of rupture, or the means by which it was brought about, the proper treatment is operation. Palliative measures offer no prospect of relief. The disability is permanent unless corrected by operative means. Excellent results have been obtained in all cases operated on at periods ranging from a few days to four years after the onset of the disability. The technic is that of a simple anatomical dissection. The risk is that of infection and should be minimum, as the conditions are entirely under the control of the operator. The necessary residence in hospital is brief and the usual period of recovery of full function has been in the neighborhood of three months.

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THE VALUE AND LIMITATIONS OF BLOOD TRANSFUSION*

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of New York

The therapeutic value of blood transfusion has received widespread attention and general recognition. Its limitations, however, have been somewhat obscured and ignored, and conclusions as to results obtained not adequately discussed and elucidated. In reviewing recent articles on blood transfusion the following features stand out:

(1) The necessity for safeguarding the operation by more careful preliminary compatibility tests, and the importance of finer qualitative estimations in order to secure the best clinical results.

(2) The superiority of unmodified blood over citrated blood, both as to immediate and late effects. Biologic tests appear to have settled this question.

(3) A tendency to discuss again the methods best suited for the transplantation of blood from one individual to another, in order to minimize biochemical changes and reactions.

One has but to refer to the articles of Unger,[1, 2] Drinker and Brittingham,[3] Bernheim[4] and Horsley-Vaughn-Dodson[5] for elaboration of these views. The writer has had a fairly large experience in blood transfusion work, and in this paper wishes to record some of his impressions and conclusions. Whole blood can be transplanted from one individual to another as homologous living tissue. Its further value lies in its hæmostatic and hæmatopoietic properties. In selected instances it may also have antitoxic and bactericidal powers. The one great outstanding indication for blood transfusion is anemia. If the anemia be posthemorrhagic—either acute or chronic, simple or pathologic—we have in blood the most efficacious of all agents, the remedy par excellence. If, on the other hand, blood be administered in blood diseases, infections, intoxications, metabolic diseases, or general debility, or for the anemia which may characterize or complicate such conditions, then we must have a clear understanding and an honest appreciation of the limitations of transfusion. In a previous article[6] the writer gave his results in the treatment of hemorrhage and the hemorrhagic diseases. Further experience has but confirmed the views therein expressed, hence a repetition of some of the important points. The following classification was found convenient:

I. Simple hemorrhage: 1. Acute posthemorrhagic anemia. 2. Chronic posthemorrhagic anemia.

II. Pathologic hemorrhage: 1. Hæmophilia. 2. Purpuric group. (a) Hemorrhagica neonatorum. (b) Symptomatic and idiopathic purpura.

III. Secondary hemorrhagic disease, such as complicates icterus, sepsis, nephritis, dysentery, blood diseases, etc.

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I. Simple Hemorrhage. 1. *Acute Posthemorrhagic Anemia.*—This may follow trauma, labor, operation or any accidental cause, or may be a complication of gastric or duodenal ulcer, ectopic pregnancy, typhoid fever, etc. In this form of acute anemia, if the bleeding point or area can be controlled, the introduction of new blood into the system will prove specific. No other measure will so promptly resuscitate a dying patient. In fact it is the only efficient remedy if bleeding has gone beyond a certain degree. When the source of the hemorrhage is not accessible without operation, as in gastric or duodenal ulcer, or typhoid fever, judgment as to the proper time to administer blood is required. As a rule it is better to wait until bleeding has stopped. If, however, the anemia is severe enough to endanger the life of the patient, even though active bleeding is still going on, it is safer to transfuse a moderate amount of blood. The hæmostatic action of new blood is often prompt and the stimulating effect is always gratifying. In the profuse bleeding, which, for example, may accompany the rupture of an ectopic pregnancy, transfusion and operation can be performed simultaneously. Transfusion is indicated in any case of acute anemia where the systolic blood-pressure is below 90 and where reaction does not follow the use of the simpler measures for combating shock, such as infusion, external heat, stimulation, etc. Generally speaking a single large transfusion meets every indication, but if necessary the operation can be repeated.

2. *Chronic Posthemorrhagic Anemia.*—This may result from repeated small losses of blood, as in persistent epistaxis, gastric or intestinal ulceration, bleeding hemorrhoids, metrorrhagia, etc. The losses of small or moderate amounts of blood cause, first, over-stimulation, and later exhaustion of the hæmatopoietic system. The ability to manufacture new blood seems for a time arrested, even though the source of the hemorrhage be controlled or removed. In this condition no other remedy will compare with the whole blood in producing hæmatopoietic stimulation. Serial transfusions of moderate amounts of blood meet the indications here.

II. Pathologic Hemorrhage. 1. *Hæmophilia.*—Without any discussion of this peculiar hereditary and congenital disease, it is now quite generally conceded that in whole unmodified blood we have the best remedy for checking the bleeding, which sometimes resists all other measures. While the disease itself is not cured, the alarming and dangerous symptom is controlled and immunity against excessive bleeding is established for a variable period. Prophylactic injections of blood should be given from time to time, for as age advances the bleeding tendency diminishes and may cease altogether at maturity.

2. *Purpuric Group.* (a) *Hemorrhagica Neonatorum.*—This disease probably belongs to the purpuric group and is due to some underlying toxæmia. It formerly was regarded as a most serious affection, with a bad prognosis, and with a mortality ranging as high as from 50 to 75 per cent. Blood therapy has given brilliant results and has reduced the mortality to 5 or 10 per cent.

Transfusion is the method of choice for correcting this dyscrasia and will often prove life-saving after the failure of all other measures.

(b) *Symptomatic and Idiopathic Purpura.*—Purpura is usually due to some form of bacterial, metabolic or chemical toxæmia. In the symptomatic variety, the disease tends towards spontaneous and permanent recovery, if the underlying etiologic factor can be determined and eliminated. Idiopathic purpura—so called constitutional purpura or essential thrombopeny—is probably a clinical entity. Prolonged bleeding time, normal coagulation time, marked diminution in the platelet count and lack of capillary resistance (Hess' test) are the essential features of the disease. Transfusion will often check the bleeding of purpura hæmorrhagica, but it by no means has the specific hæmostatic action seen in hæmophilia and hemorrhagica neonatorum. By repeating the transfusion in an obstinate case, whenever bleeding is active or anemia acute, one can often save the life of the patient. In certain instances of constitutional purpura, however, in spite of the fact that the blood loss is repeatedly replenished by transfusion, the patient grows progressively worse and eventually dies of some obscure toxæmia. In one case, in spite of eight transfusions and a splenectomy (at the suggestion of Dr. Alfred Hess) the patient finally succumbed to cerebral hemorrhage.

III. Secondary Hemorrhagic Disease.—It is probable that all types of pathologic hemorrhage, except hæmophilia and possibly constitution purpura, belong to the class of "secondary hemorrhagic disease." This term is used merely for convenience to indicate the variety of hemorrhage seen in icterus, sepsis, nephritis, blood diseases, etc. In the management of this form of bleeding, it is imperative that the original disease be given appropriate treatment. For the prevention of hemorrhage and for the control of bleeding, once it has started, blood transfusion is the most rational step.

To sum up, in acute hemorrhage, whether simple or pathologic, and in chronic posthemorrhagic anemia, we have in blood transfusion the best and at times the only efficient remedy. As a tissue transplant to replace lost blood, as a hæmostatic agent to check further bleeding, and as a stimulant to the hæmatopoietic system to manufacture new blood, the procedure is theoretically and practically sound.

Now consider the processes in which hemorrhage plays no part. What are the indications for blood transfusion? Leaving out of consideration experimental work in blood therapy, the real indications may be grouped under the following divisions:

(1) In selected cases of anemia. (2) In selected toxic and septic states. (3) In selected instances of general debility.

Anemia.—Following certain infectious diseases, such as pneumonia, influenza, the exanthemata, etc., there may develop a severe degree of simple, secondary anemia, which is slow to respond to the usual treatment. Blood transfusion is not indicated, and is of little value, during the acute disease, but after the infectious process has exhausted itself, and incidentally left the patient exhausted too, transfusion is of benefit in awakening the appetite,

improving digestion, etc., but its greatest value is in its stimulating influence on the sluggish blood-making system. It will do little good, for example, to use blood therapy to combat the grave anæmia of malaria or uncinariasis, if the malarial organism is still present in the blood or the parasites or ova are still present in the intestinal tract, but after their complete eradication transfusion will shorten convalescence and greatly hasten recovery. The same is true of the hæmolytic type of anemia which sometimes occurs during the puerperium, caused by poisons formed in the placenta. The impression made on the anemia by transfusion may be disappointing during the puerperal state, but its action is prompt and gratifying after the uterus is emptied. The same may be said of practically all of the simple, secondary anemias, which are slow to yield to the usual hygienic, dietetic and medicinal plans of treatment, that, if the cause can be determined and removed, then recovery can be materially hastened by transfusion.

(2) *Pernicious Anemia.*—When the blood picture is such that the anemia can be placed in the " pernicious " group, we have to deal with a " malignant disease of the blood," an incurable affection. It often represents a late, sometimes the terminal stage, of a low-grade, insidious form of sepsis. It is obvious that attempts should be made to eradicate all foci of infection, which might have a causative bearing on the anemia. While transfusion never cures, it is our best remedy for this disease. Splenectomy is indicated in selected cases. Hitzrot[7] has given sound advice on the selection of cases for splenectomy and his views should be given serious consideration.

(3) *Leukæmia.*—Transfusion makes but little impression on even the chronic types of leukæmia and, in my experience, is absolutely useless in the acute lymphatic variety.

In Toxæmia and Septicæmia.—Transfusion has been tried in the acute stage of certain infectious diseases with the idea that healthy blood might possess antitoxic properties. The results, for the most part, have proved disappointing. Except for its transient stimulating and strengthening action, it seems to have little effect. It would appear theoretically logical and practically correct to use the blood of immune donors to combat the infection of such diseases as typhoid fever, scarlet fever, measles, etc., where recovery from the attack gives lasting immunity, but the fact that the majority of the victims of these diseases recover under ordinary treatment, that it is difficult to secure proper donors at the right time, and further that the immunizing factors do not reside solely in blood, but in the body cells as well, have prevented any systematic studies in this direction. The effect of transfusion, when used to overcome the acute intoxications of diabetes, uremia, hyperthyroidism, etc., is practically negative. Crile advocates transfusion in acute hyperthyroidism in order to increase " internal respiration " and thereby to combat " intracellular acidosis." Can such a theory be sustained? In illuminating gas poisoning transfusion—preceded by blood letting—is a rational procedure and has given good results. Efforts at treating opium and bichloride of mercury

poisoning along the same lines have, to our knowledge, resulted in failure. What else could be expected?

Many attempts, on my own part, to influence the course of acute septicæmia and bacteræmia by blood transfusion have proved futile. When the infection reaches a subacute or chronic stage, especially if anemia is a prominent symptom, then will the strengthening and stimulating effect of new blood make its influence felt. Mere anemia and exhaustion, as has been pointed out by Ottenberg, may be all that prevent the overcoming of an infection. It goes without saying that the original focus of infection should be given appropriate treatment and, if possible, eradicated if we are to get the best results.

General Debility.—Transfusion, as a pre-operative measure, has enabled many an anemic, debilitated and doubtful surgical risk to go safely through the ordeal of an operation. It has often tided such a patient over that critical period immediately following a trying operation. It has on occasion, in infantile pyloric stenosis, after operation, proved life saving, by supplying fluid, and nutrient fluid at that, to the desiccated and starved-out tissues. It has been an aid, when judiciously employed, in overcoming the anemia and general weakness, in certain protracted diseases or painful injuries, where suffering and prolonged confinement rendered the outcome slow or doubtful.

The Best Method of Blood Transfusion.—What is the best method of blood transfusion? Now that it has been demonstrated by clinical and biologic tests that unmodified blood is superior to citrated blood, what is the best method of transfusing unmodified blood? The answer is not difficult, that method which most closely approaches vessel to vessel anastomosis, without the obvious inconveniences, uncertainties and disadvantages of the latter. The syringe-cannula or the syringe-stopcock-cannula methods closely approach direct transfusion and (1) can be employed with a minimum of inconvenience and pain to donor and patient; (2) can be repeated at will; (3) the transfused blood can be given in any desired amount, and can be measured accurately; (4) and the blood is outside the body a minimum of time and is transferred in its natural state, thereby lessening the chances of unpleasant reactions. The operation is relatively easy but it is not as simple as is generally thought. Practice and the minutest attention to details are necessary in order to carry out the procedure successfully.

Blood transfusion is a valuable expedient when employed with proper discrimination as to indications. Except in hemorrhage or the hemorrhagic diseases, however, it has but little curative effect, but as a palliative resource its powers for good are far-reaching.

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TRANSACTIONS

OF THE

NEW YORK SURGICAL SOCIETY

Stated Meeting Held November 8, 1922

The President, Dr. John A. Hartwell, in the Chair

STAB WOUND OF SPLEEN

Dr. DeWitt Stetten presented a young man, sixteen years of age. At about five-thirty P.M. on May 3, 1922, a comrade stabbed him in the left side with a hunting knife. A small wound was made that was not regarded as serious by the doctor who first saw him and who gave him emergency treatment. He walked home, took dinner, and at about eight P.M. began to have some abdominal discomfort which gradually increased, until about one A.M., May 4th, when the family physician was sent for. He recognized at once that there was some serious abdominal injury and sent the patient to the Lenox Hill Hospital. His temperature had risen to 103.4°, his pulse was 130, and his respirations 60. The entire abdomen presented a board-like rigidity and was exquisitely sensitive. There was a leucocytosis of 18,000, with 80 per cent. polymorphonuclears. A small, insignificant stab-wound was noted in the mid-axillary line on the left side between the ninth and tenth ribs. The examination of the chest was negative. An immediate laparotomy was performed. An oblique incision was made, parallel to the left costal arch. On entering the abdominal cavity, a large quantity of fresh and clotted blood was found which was swabbed and suctioned out. The spleen was at once examined and on the external surface near the posterior border was found a small stab-wound, about one-half inch in length and about one-quarter inch deep, which was bleeding profusely. This wound was closed by several simple, interrupted silk sutures, which seemed to control the hemorrhage. As an extra precaution, a narrow gauze tampon was led down to the injured area and the abdominal wound was closed in the usual fashion. The patient made an entirely uneventful recovery.

ABSCESS OF THE LUNG

Dr. Nathan W. Green presented a woman, aged twenty-eight, who was admitted to the medical service of St. Luke's Hospital on March 30, 1922, and was referred shortly after to the surgical service, Division A.

The history was as follows: Three weeks ago the patient underwent a tonsillectomy. One week after there began a sharp stabbing pain in the right axilla and at the same time cough and expectoration of considerable black material. The cough continued getting worse daily. Profuse expectoration of grayish-green material of foul taste and bad odor was now present.

Physical Examination.—Normal except that she had a grayish-green sputum of foul odor and the right lung presented harsh vesicular breath and voice sounds, impaired resonance, dulness with diminished breath sounds and voice of bronchial quality. Moist râles were found during inspiration below the clavicle anteriorly and in the axilla. Röntgenograms taken by Dr. L. T. LeWald showed the presence of a lung abscess with a fluid level.

She was operated upon for drainage of this lung abscess by the two-stage procedure. The first stage was done on April 6, 1922, under local anæsthesia, making an incision in the axilla and removing three inches of the second rib. The costal pleura was exposed and the wound packed with iodoform gauze. The second stage was done on April 15, 1922, the packing of the previous operation was removed and a large exploring needle was passed in every direction and no pus was found. The wound was packed with iodoform gauze, packing down into lung tissue that had been penetrated by finger (blunt) dissection.

On April 26, 1922, the iodoform packing was removed and it was found that the abscess had opened from packing the area as was evidenced by the characteristic smell of the pus and by the blowing of air.

On May 7, 1922, she was discharged with a small granulating area and a bronchial fistula with slight discharge. She reported for dressings occasionally and was healed the latter part of May. This patient was married in June and has been well ever since the closure of her bronchial fistula.

Doctor Green presented a second case of lung abscess, in the person of a man, aged thirty-seven, who was admitted to the surgical service of the First Division, St. Luke's Hospital, January 2, 1922.

The history was as follows: Cough and sputum. Duration three months. Three months previously he was operated upon for gall-stones. His sputum became yellow, frothy and of a very foul odor. The pain radiated to the right chest anteriorly just below the acromion end of the clavicle. The pain and cough were progressively worse.

He was a fairly well-developed man appearing chronically ill, who coughed almost continually and expectorated a very foul-smelling sputum. Breath sounds harsh. Right chest dull with diminished breath sounds at lower angle of scapula posteriorly. Few râles heard about this locality. Anteriorly no change in percussion noted. Many fine crepitant râles were heard at the end of inspiration beneath the right clavicle and down about two ribs. Fremitus normal anteriorly, absent over scapula area posteriorly.

His Wassermann reaction was negative. Röntgenograms taken by Dr. L. T. DeWald showed a typical lung abscess with a fluid level.

He was operated upon by the two-stage method for drainage of the abscess. The first stage was done January 10, 1922; a vertical incision was made over the fifth and sixth ribs along the medial border of the scapula, and the ribs were removed for about three inches. The intercostal muscle between the ribs was ligated and removed. There was a

hard point palpable 4 cm. in diameter at the midpoint of the incision. There were no pleural adhesions and the parietal pleura was accidentally opened beneath the sixth rib. The wound was packed with plain gauze for the purpose of forming adhesions preparatory to a second operation. The second stage was done January 21, 1922; the wound was explored and dense adhesions were found about the site of the abscess. The abscess was palpated and explored with a needle; a small amount of pus was withdrawn, the cautery was inserted and the presence of the cavity established by making an opening of 2½ cm. in diameter. When the patient coughed, pus exuded freely. A tube was inserted into the abscess and the wound packed with iodoform gauze about the tube. There was a subacute emphysema for a while.

The patient was discharged February 16, 1922, cured. He had gained thirty pounds in weight and has remained well since his leaving the hospital.

DOCTOR GREEN presented a third case of lung abscess in a man, aged fifty-three, who was admitted to the surgical service, First Division, St. Luke's Hospital, December 21, 1921.

The history was as follows: While working, the patient "felt something break in his right chest." This was followed almost immediately by bleeding. He coughed up a considerable amount of red blood and pus which had a very foul odor. For eleven months since then he has coughed daily and expectorated a great deal of foul-smelling sputum, especially on first awakening in the morning; often raising as much as a cupful at one time. He had had no septic condition as far as known. But about seventeen years previously was in a tuberculosis sanatorium. His sputum was always declared negative for tubercle bacilli.

He was a well-developed but poorly nourished man. There were a few moist râles, between the spine and the angle of the right scapula. The breath sounds were amphoric. The voice came through more clearly and there were a few large moist râles. There was clubbing of the fingers and toes.

Röntgenograms taken by Dr. L. T. LeWald showed a large cavity with a fluid level (Fig. 1).

He was operated upon by the two-stage method. The first being December 24, 1921. An incision was made over the seventh and eighth ribs at the angle of the scapula, removing three inches of the seventh and eighth ribs with the intercostal muscles. The pleura seemed to be adherent over most of the underlying area; so a needle was passed into the lung for a distance of about one and one-half inches and purulent material obtained. It was decided that to open the pleural cavity was safe in this instance; so a very small incision was made into the pleura but with a resulting inrush of air; consequently the wound was packed open with plain gauze packing and nothing further done at that time. The second stage of the operation was performed on December 31, 1921. The packing was removed and the abscess explored with a needle and greenish pus found. The abscess was opened with the cautery through a tract about 1 cm. wide and 3 cm. deep, the cautery being introduced into the centre of the abscess until pus came out. A soft rubber tube

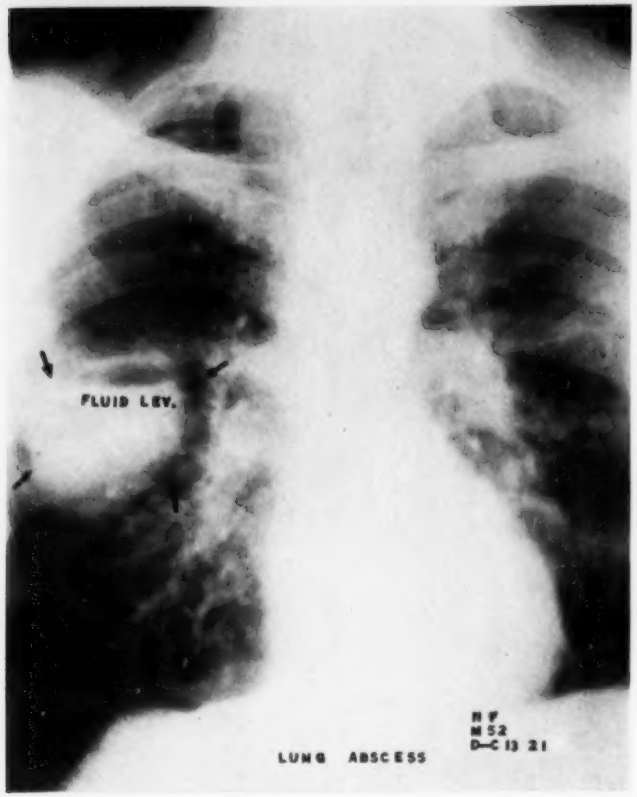

FIG. 1.—Case III. Lung abscess, eleven months duration. Showing fluid level. (Röntgenogram by Dr. L. T. LeWald.)

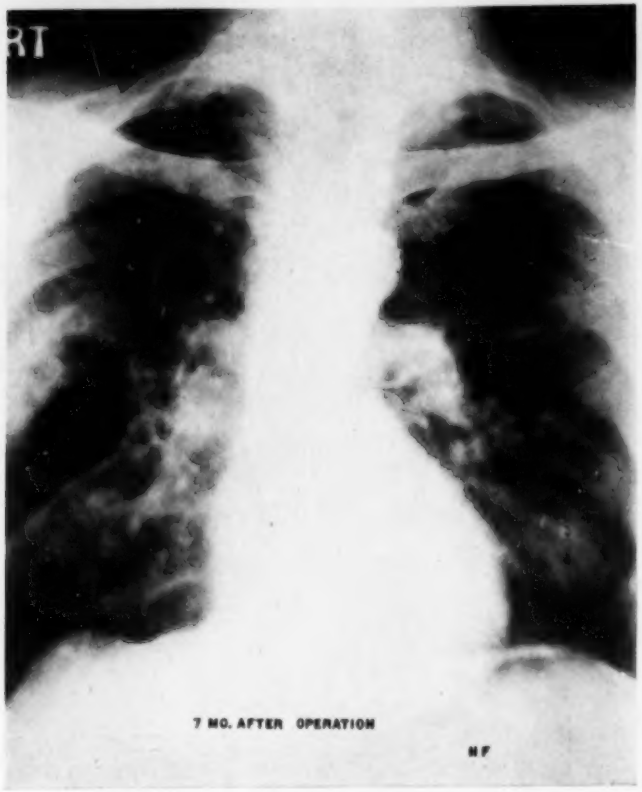

FIG. 2.—Case III. Appearance seven months after operation for lung abscess. Two stage method. (Röntgenogram by Dr. L. T. LeWald.)

was inserted into the abscess cavity and plain gauze packing was placed loosely about the tube.

The patient was discharged cured February 22, 1922. He subsequently gained thirty pounds and remained well until about a week ago, when he acquired a severe coryza and during the past week has lost some weight.

Dr. Howard Lilienthal remarked that four weeks was rather a short time to observe a case before operating unless the abscess was progressing or the patient deteriorating. These cases should be carefully watched and artificial pneumothorax should be tried once at least. He had had one case recover, a short time ago, which was almost exactly like Doctor Green's post-tonsillectomy case, and she recovered after three refills of air. This procedure is of no use in old chronic cases. Doctor Lilienthal expressed his belief that a lateral view röntgenogram was very important before operation, as was examination with the fluoroscope with the patient's arms behind or over the head. A shadow view should be taken in three directions. One should know as much as possible about the location and size of the abscess before operation. The lateral view is taken too seldom. A word should be said regarding the cause of hemorrhage in these operations. It is due to a sloughing process which extends into the walls of the blood-vessels, and in the progressive cases many of these patients will die of hemorrhage of the lungs. Doctor Green had said he opened his way into these abscesses with the cautery, and Doctor Lilienthal hoped he would not continue to do so because he had had sad experience with the cautery. Anywhere between the third and fourth day, and even as far as the tenth day, a slough will fall out of a vessel that has been burned and the patient will bleed to death. He had a patient bleed to death in this way following attempted drainage in bronchiectasis. In trying to enlarge the abscess cavity bleeding started and was controlled with packing. One week afterward he bled again and preparations had been made to transfuse him, when he bled the third time and died. In these bronchiectatic cases there is progressive sloughing going on and on. The danger of opening an abscess of the lung by cautery is altogether disproportionate to its supposed advantages. By entering bluntly one can push the vessels aside with little danger of injuring an artery unless it is sloughing. Doctor Lilienthal said that he had recently used, in a number of cases, intratracheal suction when the patient was anæsthetized. A small catheter was slipped down nearly to the bifurcation, an ordinary syringe was attached and was operated by an assistant every few minutes, and it was astonishing how much pus could be thus evacuated. Before operation, posture treatment was gone through to empty all the pockets. This method was an excellent one and should be used in every case.

Dr. Willy Meyer, referring to the early treatment of lung suppuration due to aspiration, said that recently in the bronchoscopic department of the Lenox Hill Hospital it had been possible to treat five cases *early* for beginning suppurative inflammation of the lung subsequent to aspiration, three after

tonsillectomy and two after aspiration of stomach contents, and these five cases had been cured. If this intrabronchial aspiration and treatment is done early, it will, he believes, become the method of choice rather than artificial compression of the lung with the help of gas. It stands to reason, that if that aspirated infectious material is removed as soon as possible, these patients will have a better chance to get well than if the material is left within the bronchial tree.

Dr. Hugh Auchincloss said that some of the cases of lung abscess at the Presbyterian Hospital had done very well with open-air therapy on the roof without bronchoscopy or operation, but they had been deep-seated lesions near the root of the lung and were not very large cavities. He had been much impressed with the first case Doctor Green presented, which reminded him of a case of his own which had presented almost no physical signs; the abscess was in the same place and of about the same size, and the diagnosis was evidenced by the amount of sputum and X-ray. The two-stage operation was, in his opinion, the best procedure where the cavity could not be readily and accurately located or was not adherent to the chest wall. A marker that would show up clearly in the X-ray, such as a safety-pin, could be attached to the depths of the wound when packed at the first operation and aid in localizing for the second-stage procedure. The posture of the patient is very important, especially where a long bronchus communicates with the cavity. Local anæsthesia and readiness to change the patient quickly from one position to another on entering the cavity, or if there is excessive bleeding, are important.

Doctor Green, in closing said that the diagnosis in these cases had been made by the sputum and röntgenograms which had been worked up very carefully. Profile X-rays were taken in the first case. None had been shown to be tuberculous. Enthusiastic coöperation had been shown by Doctor LeWald of the X-ray Department. The case of the woman operated on for lung abscess, four weeks after tonsillectomy, was an early one, and he admitted the justice of Doctor Lilienthal's criticism. He was inclined to side with him and think she might have been given a longer time to see if she would recover without operation; but she was badly toxic and had a large abscess. So it seemed best and reasonable to go on and operate without waiting for a possible spontaneous but delayed recovery. Doctor Green recalled one case that he had turned back to the medical service to collapse with nitrogen in which the patient apparently recovered without further operation. One should select the cases. Some can be collapsed very well. But in going in surgically one sometimes finds adhesions and sometimes no adhesions, and this cannot be found out beforehand. If the lung has been collapsed with nitrogen, the adhesions may hold the area over the abscess out against the chest wall and prevent collapse of the very part one is seeking to influence. However, he believed many of these patients should if possible be given the benefit of the doubt. Whether the opening through the lung tissue should be made by cautery or by blunt dissection might be considered a moot question.

Doctor Green had had a fatal case by blunt dissection which matched Doctor Lilienthal's unhappy experience with the cautery. It was a matter of something beyond one's control. One could not see whether one were eroding a vessel or not by the cautery. He was careful, however, when he used the cautery to burn a big hole with a dull red tip, so the sloughing might be sufficiently deep to cause considerable thrombosis, so hoping to avoid hemorrhage after operation. In regard to Doctor Meyer's remarks about bronchoscopy, he believed Doctor Yankauer had been doing some remarkable work with it, although the speaker had not used it. He liked to use local anæsthesia as much as possible because it did not destroy the tracheal reflex. Should general anæsthesia be required, the posture treatment should by all means be given so that these patients might spill out what pus there might be in the cavity before the general anæsthesia. He remembered a case operated upon some years ago by the late Dr. Henry H. Janeway and himself, who, he thought, died of aspirating pus from one lung to the other during the operation. This patient never came out of the anæsthetic.

ATYPICAL CHRONIC EMPYEMA

Dr. Willy Meyer presented two patients treated for a rather atypical and rare type of empyema. Both had been shown before in the course of the after-treatment. The first patient was a woman, twenty-eight years of age, who at the age of four had developed a post-pneumonia empyema which was treated with rib resection and drainage. A fistula persisted. Before 1917 she had been operated on four times; then she came under Doctor Meyer's care. The X-ray showed a long, sausage-shaped cavity parallel with the spine. Doctor Meyer removed the entire roof of the cavity after a skin muscle flap had been turned up, and then allowed the raised flap to heal on to the visceral pleura. There was no possibility of making decortication. The operation was done in three stages and the entire cavity was firmly healed and had been for about one year.

The second patient had inherited tuberculosis and had suffered from acute pneumonia with following empyema which developed in 1919. He came under Doctor Meyer's care with acute empyema. A piece of rib was resected and the lung was found collapsed with a large bronchial fistula. He was improved with Dakin's solution and it was then decided that as the lung could not possibly come to the chest, to bring the chest to the lung. A typical Schede operation was done under local anæsthesia and a large entrance was found into the lung. In two years the cavity has completely healed. There was for a while a persistent sinus. He was treated at the office with the Kromayer lamp. The quartz probe entered the canal for more than two inches. Total cicatrization and final complete healing resulted.

RADICAL OPERATION FOR CHRONIC EMPYEMA

Dr. Carl Eggers presented a youth, sixteen years of age, who when about four years old had contracted measles, diphtheria and pneumonia, which were followed by empyema. A rib resection was done, and after

many months the empyema healed. In the next few years there were frequent recurrences, and as a result of these the patient remained an anæmic, undernourished child. He was subject to chills, cough and nightsweats and was considered a tuberculous suspect, though no positive laboratory evidence was ever obtained.

In December, 1914, when he was eight years old, he was admitted to the Lenox Hill Hospital. A radical operation was done in two stages with an interval of one week. Portions of five ribs were removed and the lung decorticated. The wound healed after several months and has remained so. The question of preventing deformity was an important one, especially in view of the fact that the boy had only one leg, the other having been amputated in the mid-thigh following an automobile accident. This was accomplished by setting up exercises, and by wearing a corset during the growing period. The corset has been discarded only within the last few months. He is now a robust boy, able to engage in exercises and sports. His muscle function is normal. There is but very slight curvature of the spine.

Doctor Eggers also presented a man, twenty-six years old, who at the age of fourteen developed an empyema, for which a rib resection was done. The wound never healed and the discharge continued profuse. There was no cough. In the following years several operations were done and pieces of different ribs removed, both in the posterior and anterior part of the chest.

When he came under observation in March, 1921, he was in good physical condition. The right chest was collapsed and moved but slightly. Four scars of former operations were present, two in the back, one in the axilla and one in front. Two of these were healed, while the other two were discharging thick pus. One fistula was situated between the eighth and ninth ribs posteriorly, the other between the fifth and sixth ribs anteriorly. X-ray pictures taken after bismuth injections of the fistulæ showed that they communicated with each other and that there were several tortuous channels extending in different directions, one of them into the extreme anterior end of the costo-phrenic sinus. Conservative treatment was without result and radical operation was therefore proposed. In May, 1921, the first operation was done at the Lenox Hill Hospital. It was very difficult on account of extensive fusion of ribs. A long curved incision was made connecting the two fistulæ, the muscles and skin were pushed upward and parts of six ribs and considerable cartilage then removed in order to gain access to the various ramifications of the cavity. A complete decortication was done, and the lung was found to be soft and mobile. A narrow fistula was found to extend upward to an unsuspected cavity. On account of the patient's condition it was not thought wise to do anything with that, however, except to enlarge the opening into it and to introduce Carrel tubes. The muscles and skin were closed and drainage instituted at the dependent part. The patient reacted well. The upper cavity was treated by the Carrel-Dakin method, but healing failed to take place. A second operation was therefore done September 26, 1921. At this time the lower wound was found well healed. The upper cavity was completely

extirpated, and the lung thoroughly mobilized. The wound healed completely in about three months and has remained so. The patient's general condition is very good, and owing to the removal of fused ribs and the liberation of his lung he feels much improved. There is no disturbance of muscle function. The patient is a butcher and is able to perform all work connected with that trade.

DOCTOR EGGERS also presented a woman, twenty-four years old, who first came under observation October 25, 1921, for a discharging thoracic fistula. She gave the following history: In July, 1919, she contracted pneumonia following childbirth. An empyema developed which was drained by rib resection. She was confined to the hospital for three months and was then transferred unhealed to a sanitarium for tuberculous patients, where she remained nine months. Since that time she has been treated at home with one irrigation daily. The patient stated that she had been well until the present illness. She ran a septic temperature while in the sanitarium. She had positive tuberculous sputum on only one occasion. Her child has remained well. She was admitted to the Lenox Hill Hospital for observation, where the following facts were noted: 1. There was no temperature or increased pulse. 2. There was no cough or expectoration. 3. Examination of the discharge from the sinus showed streptococci and tubercle bacilli. 4. The skin reaction was positive for tuberculosis. 5. A tuberculous focus was noted in the apex of the opposite lung. 6. Injection of the cavity with bismuth showed that it extended from the sinus in the bed of the ninth rib to the fifth rib.

Radical operation was decided on, and the patient was put on regular Carrel-Dakin treatment to clean up the cavity preparatory to operation.

November 14, 1921.—Operation. The object was to mobilize the chest wall and lung and to remove all diseased tissue. A long hook-like incision was made starting well up on the inner border of the scapula and encircling the fistula below. Portions of six ribs were removed, as well as the corresponding intercostal tissues. The entire outer wall of the cavity, which was one-half inch thick, was then removed. A large flat cavity was exposed which showed one recess extending upward and one inch into the anterior and posterior costo-phrenic sinus. The latter were completely shelled out, liberating the lung and diaphragm thoroughly at that point. The cavity was packed with iodoform gauze and the muscles and skin then closed.

The operation had been done under chloroform-oxygen anæsthesia. It was well borne. The convalescence was uneventful. The tampons were not disturbed until the second stage of the operation, two weeks later.

November 26, 1921.—Second stage. At this time the skin and muscle incisions were reopened, and the tampon removed. There was no retention of pus. In order to expose the recess extending upward, which was noted at the first operation, it was necessary to remove short pieces of two additional ribs, and two inches of the fourth and one inch of the third rib were therefore resected. All endeavor was now directed toward mobilizing the lung by a thorough dissection of the thick-

walled angle of pleural reflection. After this had been accomplished an incomplete decortication was done and the wound then closed. No attempt was made to inflate the lung. One iodoform and two plain gauze tampons were inserted.

The convalescence was uneventful. The tampons were removed one week after operation. The after-treatment consisted in injections of the cavity with iodoform oil and exposures to artificial sunlight. Though the cavity obliterated after a few months, a small superficial sinus proved quite obstinate and did not heal entirely until August, 1922.

The patient's general condition improved considerably. In September she weighed 101 pounds, which was more than she had ever weighed. There is no cough. She is able to do her own housework.

The tissue removed at both operations showed typical tuberculosis.

It is of interest to report that since the patient went home, apparently cured of her disease, her little boy became afflicted with tuberculosis of the spine, for which he is at present under treatment at the New York Hospital for Ruptured and Crippled.

Doctor Eggers presented a fourth patient, a man twenty-four years old, who was admitted to the Public Health Hospital, New York, in November, 1920, with the following history: In September, 1917, while in the Navy, he fell from a height of forty feet and fractured the third and fourth ribs on the left side, lacerating the lung. Subcutaneous emphysema developed. The wound did not heal. Later the sinus was curetted without result. In May, 1918, the diagnosis of empyema was made and a portion of the sixth rib resected. In July, 1918, an intercostal incision was made in the eighth space. In April, 1919, a radical operation was done and portions of four ribs were resected. In June, 1919, a so-called Beck skin-sliding operation was performed after the resection of additional portions of ribs. He was again operated upon in August, 1919, at which time the denuded surface of lung was skin-grafted. The patient applied for treatment because the wound had never healed. He had to be dressed once or twice a day. A steel plate had to be worn for the protection of his lung and heart.

When he came under observation he presented a large open cavity in the left thorax in which the lung and pericardium were visible. The exposed surfaces of these organs were partly covered with skin grafts, and in the other areas showed sluggish ulcers. The rib margins extended slightly beyond the cavity below and on the sides and formed an overhanging roof above, so that the dome of the cavity was not easily accessible to treatment (Fig. 1). There was no cough, but the X-ray showed a tuberculous focus in the apex of the opposite lung. A radical operation was decided on in order to flatten out his chest, to remove all diseased tissue and to cover the exposed lung and pericardium with skin and, if possible, also with muscle.

December 3, 1920.—Operation. An incision was made along the margins of the cavity. The skin and muscles were pushed back. Portions of eight ribs were then removed in rapid succession. The lung was mobilized and completely decorticated, which was easier than had been anticipated. During this process a pocket was opened which con-

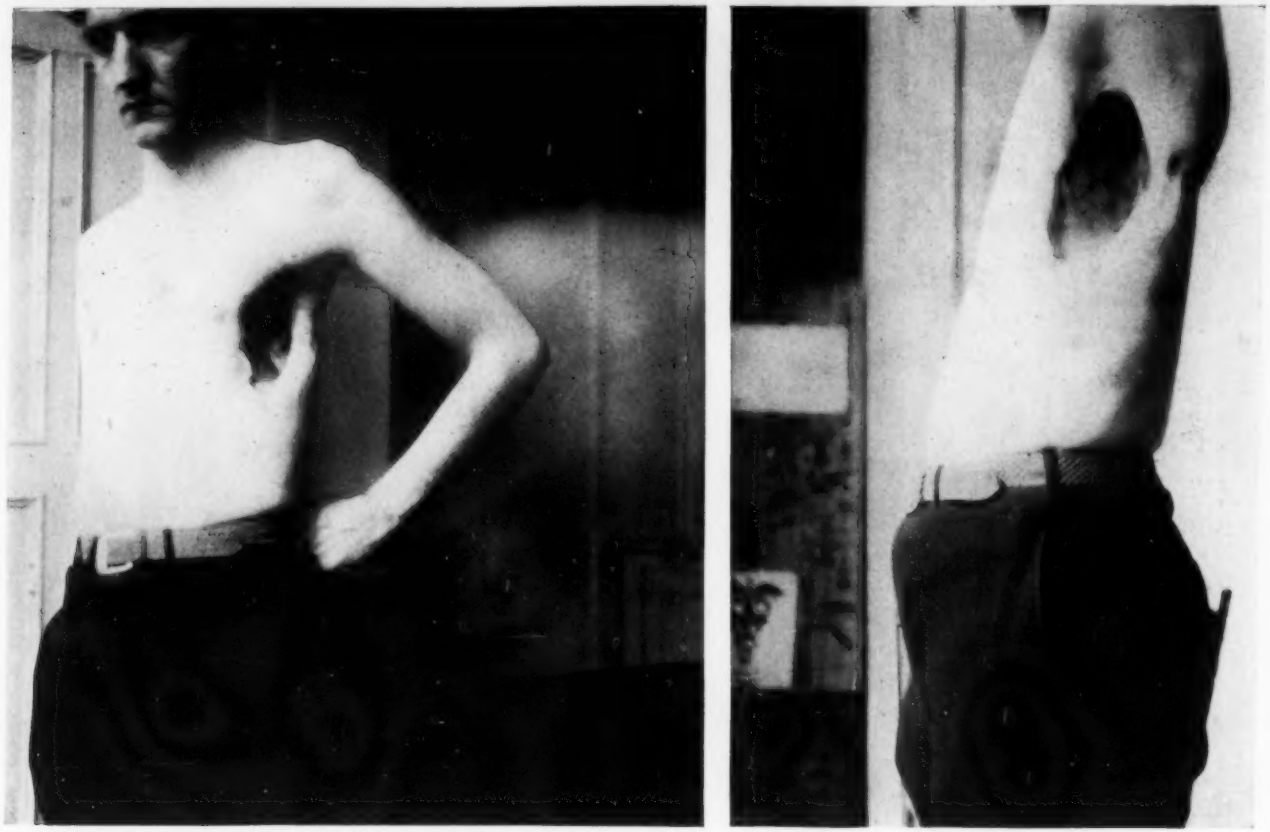

FIG. 1.—Result after Beck skin-sliding operation. Appearance of wound on admission to hospital.

FIG. 2.—Final result. Exposed lung and pericardium completely covered with skin and partly with muscle.

tained about two ounces of typical rice bodies. It was completely extirpated. Very little intact muscle was found. Whatever there was present was utilized to best advantage for closure, and the skin flaps were then united. Two small tube-drains were placed at the lower end of the wound. There was very little reaction and the wound healed kindly, except for an infolding of the skin at the junction of flaps. In order to overcome this a second operation was performed on June 20, 1920. It was not of great magnitude. Except for an obstinate eczema of the skin flaps the convalescence was uneventful. The lung focus did not become acute after operation. The excised tissue proved to be typical tuberculosis.

The patient is now entirely well. He has no cough or other evidence of tuberculosis. His chest wall is firm. There is no secretion whatsoever. No protection for the chest wall is required (Fig. 2).

RADICAL OPERATION FOR CHRONIC EMPYEMA

DR. CARL EGGERS read a paper with the above title, for which see vol. lxxvii, p. 327.

DR. HOWARD LILIENTHAL said there was only one thing in which he differed from Doctor Eggers and that was in the extent of his resections of rib. He thought four inches from six or seven ribs was more than was necessary. He had started in 1914, and had practiced with great success ever since, the use of the incision which Torek makes for intrapleural œsophagus operations, which is an intercostal incision in the seventh space. Then, if the cavity is toward the back, he cuts the ribs posteriorly above the interspace, but does not resect, puts in a rib spreader, and gets a perfect view of the inside of the chest. Every part can be seen from the apex down to the base. He clears off the exudate from the visceral part of the pleura and then makes drainage by enlarging the original fistula and making it large enough to get to the bottom of the chest. He closes it in the same way that Doctor Eggers does, but he thinks he avoids the deformity that follows too large rib resection. Of course, careful measurement will always show a smaller capacity on the sick side. With that slight exception, Doctor Lilienthal expressed himself in perfect accord with Doctor Eggers in the principles and practice of this important subject.

DR. NATHAN W. GREEN remarked that there were one or two points for reflection, and one was the difference between chronic empyema and chronic open pneumothorax. He thought one slid into the other, but that there seemed to be a difference. He was interested to learn that he used bismuth fearlessly in his injections into these cavities. He knew there were those who feared to use it. Doctor Eggers had mentioned the time as a factor between the first and second operations. Time undoubtedly is a factor in closing these cavities, for if one waits long enough a large part of the open pneumothorax cavity formed at the first operation will be found to be obliterated in certain cases, either by the action of pressure by coughing, etc., or by a progressive growing together of the parietal and pleural surfaces around the periphery where these two surfaces form a circle of contact.

Another point was that the first operation might be a valuable index to the patient's power of resistance to further procedure. If a patient did not stand well a small operation at first, one would know that he would offer little resistance to a larger operation later, and *vice versa*. Doing the operation in stages and observing the results between times is important in getting these patients through alive.

DR. H. H. M. LYLE said that as a matter of record he would like to confirm Doctor Eggers' figures. He was a member of a commission appointed by the Surgeon General of the Army to inspect Fox Hills Hospital. The commission at that time inspected Doctor Eggers' report in mortality figures and found them much more favorable than the figures of similar class of cases in the large hospitals in New York.

DR. WILLY MEYER said that Doctor Eggers had spoken of the possibility of healing an old cavity by means of improved thorough drainage. The speaker had often seen this. Take a case of empyema fistula in the eighth intercostal space and a poorly drained cavity-remnant near the apex, found by radiography after injection of bismuth. If one excises the skin around the sinus, resects a piece of rib, covering the sinus upward, stage by stage, including the soft parts below the ribs, and drains the upper cavity, such a chronic empyema will usually heal. The point of decortication of the lung, according to Delorme, is very important. Years ago Doctor Meyer closed a chronic empyema cavity in a child by an intercostal incision plus decortication. In another case a Thiersch graft was placed in the bottom of a circumscribed old cavity with good result. Regarding regular bismuth injections in chronic empyema, they cannot do any good in the average case, and some patients get bismuth poisoning. But the injection of bismuth in chronic empyema for diagnostic purposes should be done in every instance. Regarding radical operation, it must never be forgotten that one is dealing with chronic septics who cannot stand very much. It is wiser to do the operation in stages and, if possible, under local anæsthesia. A preliminary transfusion of blood will help many patients, and so will intravenous injection of saline or Ringer on the operating table before the patient is moved back to his bed. Regarding the remark often made about a possible post-operative deformity, Doctor Meyer considered that of no special importance. Of course one should try and cure the patient with as little deformity as possible, but the main thing is to close the cavity.

DR. JOHN A. HARTWELL called attention to the different subdivisions of the entity known as chronic empyema. His classification presented by Doctor Eggers brings easily before those surgeons who do not see a large number of these cases the fact that each one must be treated according to the actual pathology present. It is very important that one should have a definite knowledge of the exact condition before undertaking the operation, and with this knowledge proceed along definite lines for its cure.

DOCTOR EGGERS agreed with Doctor Lilienthal about the desirability of reducing the after deformity, but explained that the cases he had shown were

not selected from the standpoint of lack of deformity, but because they had been very severe cases when they came to operation. Many of his cases had very little deformity and it was often possible to get such a result. He agreed with Doctor Lilienthal that not only deformity was to be considered, but the function of the lung, and he felt that if one removed short pieces of ribs and mobilized the lung to such a degree that it could expand to the limits of the thorax, the best results were attained. As far as operations for tuberculosis were concerned, he was still trying to feel his way. Regarding the bismuth, he had not used bismuth paste but bismuth oil which was originally used by Doctor Stevens of the empyema commission. The preparation consisted of bismuth subnitrate twenty parts, gum acacia three parts, and cottonseed oil 100 parts. This oil can be injected easily. After it is allowed to run in, one plugs the opening, takes the picture and then removes the plug to get the oil out. After the oil has run out one takes another picture to show if there is pocketing. By using this method no case of poisoning has ever resulted.

CALCULOUS CAST OF PROSTATE

Dr. DeWitt Stetten presented a cast of the prostate removed from a man sixty-eight years old. He was admitted to the Lenox Hill Hospital on May 8, 1922. He complained of a complete urinary retention of forty-eight hours' duration and gave a history of having had difficulty with urination and occasional attacks of retention during the past six months. Gonorrhœal infection was denied. The patient had a marked myocarditis, chronic emphysema and bronchitis. On rectal examination what corresponded to the prostate was felt as a rather larger than normal stony-hard mass of the shape of the prostate, which gave the sensation to the examining finger of a "bag of stones" under the rectal mucous membrane. On manipulation pus was expressed from the urethra. An immediate suprapubic cystotomy was performed under local anæsthesia and drainage instituted. No calculi were felt free in the bladder. An X-ray examination made after the cystotomy shows a large, dense irregularly oval shadow, with its longer diameter running transversely and with several lines of separation indicated. This shadow lies deep in the pelvis and in the median line (Fig. 1). It is obviously made by the calculous cast of the prostate which was felt per rectum. On May 31, 1922, the suprapubic wound was reopened, the mucous membrane over the prostatic region was transversely incised and the calculi were removed one by one from the bed of the prostate. The internal urethral orifice was completely surrounded by calculi. Five large irregularly shaped facetted stones and seven or eight smaller fragments were extracted. When the prostatic bed was emptied of calculi it felt as if a perfectly clean and total prostatectomy had been performed, with no trace of the gland remaining. The prostate had evidently been completely replaced by the calculous formation. With some difficulty the fragments were fitted together as one does a jig-saw puzzle and glued in place. The result is a composite calculus roughly the shape and size of a somewhat enlarged prostate gland with the left lobe rather larger

than the right. On the upper anterior surface is a fairly deep funnel-shaped depression corresponding to the neck of the bladder and leading into the urethra through an opening under a rather irregular bridge formed by several smaller stones (Fig. 2). The calculus is a calcium-magnesium phosphate stone. Its weight is one and three-quarters ounces. Aside from some cystitis which cleared up under treatment, the patient's post-operative convalescence was quite uneventful and he was discharged from the hospital cured, June 29, 1922. Unfortunately, he was again taken ill the beginning of August and died in the Fordham Hospital on August 6, 1922. The cause of death was given as chronic cardiac renal disease.

FIG. 1.—Radiograph of calculous cast of prostate.

FIG. 2.—Photograph of restored calculous cast of prostate. Anterior view. Applicator passes under bridge of calculi through internal urethral orifice.

CORRESPONDENCE

ANEURISM OF THE THIGH

EDITOR ANNALS OF SURGERY:

Sir:

THE appended four case reports were read before the Southern Surgical Association at Memphis, Tenn., December, 1922. Two of them are of rather more interest than the others; one, because of its size, involving the whole middle third of the femoral artery. The other because the man had only one leg.

CASE I.—A colored miner, age thirty-five, noticed a mass in the popliteal space several months before admission to the hospital. One leg had been amputated through the thigh several years before as a result of an accident in the mines. He sought hospital treatment on account of pain from the tension of the growth. A pulsating mass the size of an English walnut was found in the popliteal space. Under ether with a tourniquet snugly applied the tumor was laid open and the openings at the upper and lower ends of the cavity were closed with No. 1 chromic catgut. As we had only one leg to deal with, great care was taken in closing the wound not to interfere with the collateral circulation that might be in the sack walls or in close proximity to it. The wound healed by primary union.

CASE II.—A colored miner, age forty, was referred to me for operation for a pulsating mass in the popliteal space. He had noticed a growth about two or three months before, but had not sought treatment until it became so painful that he was unable to work in the mines. Under ether the mass was laid open and two openings found; these were closed with catgut and the cavity obliterated as in the above case. He made a good recovery and has gone back to work as a coal digger.

CASE III.—A white man, twenty-nine years of age, had his left thigh crushed in the mines in June, 1918; no bones were broken. The bruises were chiefly in the middle of the thigh on the inner side. A small pulsating tumor appeared two or three weeks later. He walked on the leg for about a month when the mass began to enlarge very rapidly. He was admitted to the hospital September 26, 1918, with a large mass on the inner side of the left thigh which occupied about the middle third of the thigh over the course of the femoral artery. The growth had pulsated up to a few days before he came to the hospital. Under ether a tourniquet was applied and the tumor laid open throughout, some blood clots were turned out and the openings at each end, which were about five inches apart, were closed with chromic catgut. When the tourniquet was removed there was very little oozing. The sack was infolded and loosely sutured up with a small rubber drain down to the cavity. The circulation in the limb

was fairly good at the end of the operation and in a few days was practically normal. He made a good recovery and has a perfectly normal limb now.

CASE IV.—A young man was referred to me January 7, 1917, with the history of an accidental stab wound of the lower inner side of the thigh just below Hunter's canal. There had been some bleeding and some clots had been removed by slightly enlarging the skin wound. When I saw him the circulation in the thigh was good and the limb was only slightly enlarged. We decided that there was an injury of some muscular branches with bleeding into the tissues and put him to bed with the foot elevated. He improved and was asking to be sent home when on January 24th he began to suffer violently and the leg became considerably swollen at this point. The following day with a tourniquet around the upper part of his thigh a long incision was made along the course of the Sartorius muscle, which was dissected up; the heavy fascia beneath was very tense, and on being incised, a false aneurism was found about four inches long with a wound in the artery about half inch long. The wound in the artery was closed with six interrupted stitches of No. 1 chromic catgut. When the tourniquet was removed there was no bleeding. The Sartorius muscle was sutured down over the arterial suture line and the cavity obliterated with catgut. A tube drain was placed in the upper end of the wound and the rest of it was closed. The circulation was normal from the time of the operation. He was kept in bed for two weeks when he was allowed to go home on crutches. At the end of five months he was reported to be perfectly well and hard at work on his father's farm.

GASTON TORRANCE, M.D.,
Birmingham, Ala.

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